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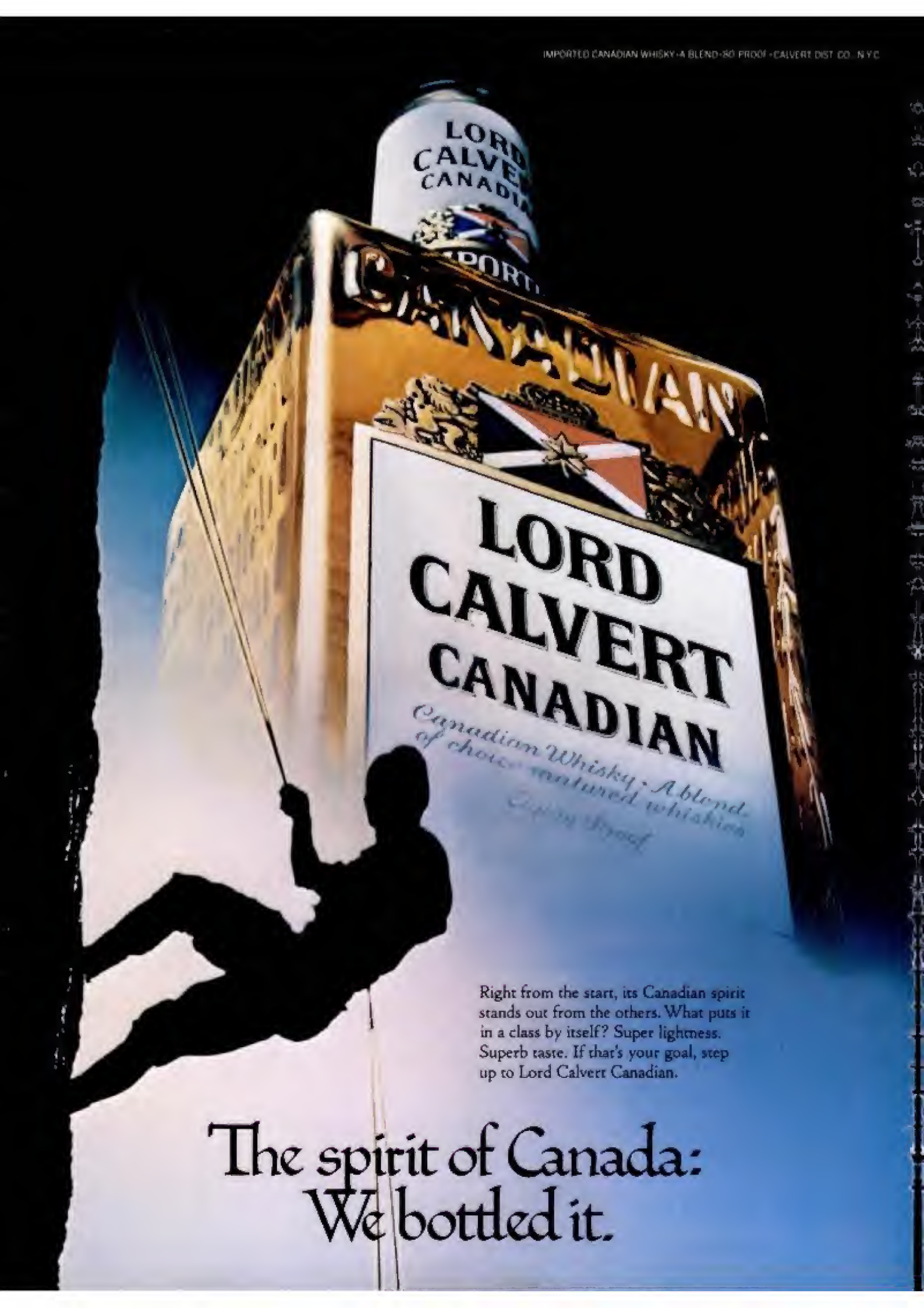


18 PAGES

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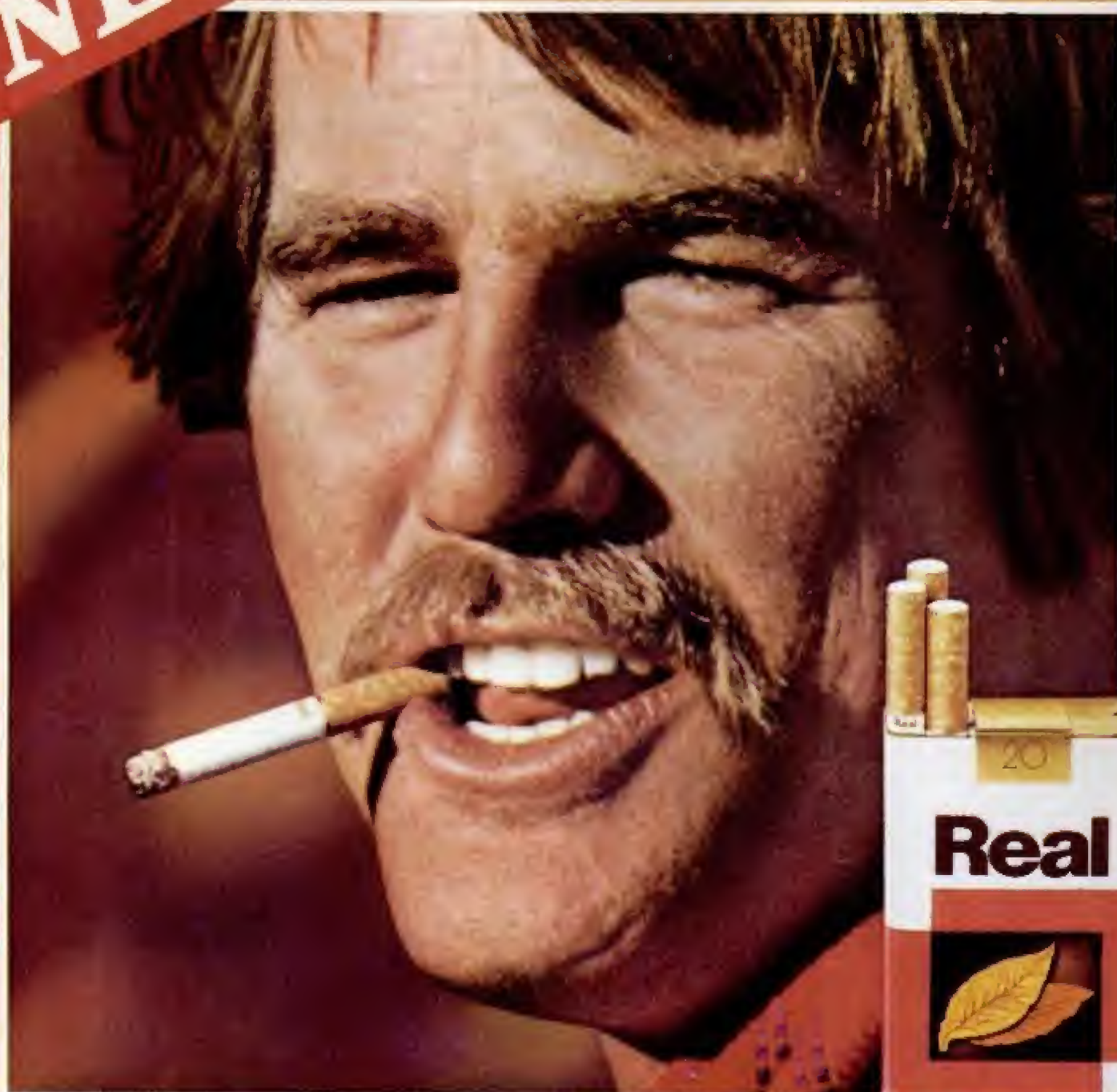
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On the cover

If you weren't lucky enough to inherit a classic wooden toolbox like this one, you can still have it without paying an arm and a leg. PM's complete plans for building and finishing it begin on page 132.
—PM photo by George Ratkai

Popular Mechanics

NOVEMBER 1979

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They don't make axes like they did back in Granddaddy's day. So I looked into chain saws. Good ones. And some bad ones, too. I held them. Ran them. And bought a John Deere.

I figured if their chain saws are near half as good as their tractors, I'd be sitting pretty.

It was worth every penny.

It's strong as a plowhorse. Just eats up hardwoods. Cuts pine like butter. And it doesn't jitter you into jelly.

Now I'm trying to decide which of their log splitters to get. Floyd up the road has the one with wheels. Swears by it.

Anyway, I hate to say it, but I'm almost glad that old ax fell down Hudson's well. This way of making sawdust is pretty close to fun.



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LETTERS TO THE EDITOR

Compass problems

Regarding the article *One That Didn't Get Away* (page 78, Sept. '79), by Christine Keller: Please inform your readers and Ms. Keller that San Bernardino [about 60 miles east of Los Angeles] is not in northern California.

RAY WASHBURN
WHITMORE, CALIF.

Ms. Keller, a native of San Bernardino, knows her geography; a gremlin swung our PM compass 180°.

Corny idea

Re: *Cushioning Playground Falls and Touchdown Sprawls*, (PM Briefs, page 71, Sept. '79). We solved this problem for our kids when we put up 16-foot trapeze bars and other gym equipment. We used ground-up corncobs from a local mill. About 10 inches will absorb the shock from the worst fall. The cobs will rot somewhat within a year or so, so we stirred them up each spring and added about 4 inches of new cobs—it worked well for years.

HENRY PEABODY
MEMPHIS

Flying the ring

Re: *Flying Rings Around You* in the September issue (PM Briefs, page 71): How do you get a 3-inch diameter with an 8½-inch circumference? $3.14 \times 3 = 9.42$ inches. Also, I could not get it to fly, no way. It just flopped and fell every time.

ED CALDICOTT
HUNTINGTON, N.Y.

The specifications for the paper cylinder in the drawing make more sense if the paper is folded along the longer dimension rather than along the shorter one pictured. Ten ½-inch folds subtracted from 11 inches leaves considerably more than a 2½-inch remainder. In addition, the largest cylinder that can be rolled from an 8½-inch length has a diameter of about 2.7 inches; any overlap would reduce this figure.

Incidentally, I did have fun flying the thing, despite the uncomfortable stares of my office colleagues.

CHARLES M. CEGIELSKI
CHICAGO

Ed. Note: "Inventor" Login rounded off 2.7 inches to 3—good enough for the Rutgers University Physics Dept., but not for demanding PM

readers. Nonetheless, it does fly, if rightly assembled.

The paper ring is cute. An article on page 46 of my 1968 *Popular Mechanics Do-It-Yourself Encyclopedia* calls this airfoil design a "hoopskirt" or "flying barrel," or, more technically, an annular wing. The article said that Louis Bleriot tried to fly this wing on floats off the English Channel, and that it was one of the earliest of all aircraft designs.

ROBERT SPIEGEL
GURNEE, ILL.

Pipe dreamer

In the May '77 issue you ran an article on pipe carving (*Carve Your Own Dream Pipe*, page 255). In the same issue, page 264, was a tobacco ad featuring a uniquely-shaped pipe. For only nine dollars I made a duplicate.

BRIAN PUCK
ARVADA, COLO.



Reader Puck's handmade pipe

Atomic blast

Having enjoyed PM over the years, I was disappointed to find a no-growth, no-business, no-technology PM Brief in your July issue, *The Atomic Planet*, (page 31). The biased half page is filled with incorrect information and half-truths, apparently intended to scare your readers regarding nuclear energy.

You first make fun of the Russians for not taking the Three-Mile Island accident seriously. But when you consider that nobody was injured as result of the accident, what other conclusion could they reach? Even Ralph Nader recently said that it wasn't a serious accident. Thirty years of energy production without an injury to the public speaks well for nuclear safety—in spite of the excitement of Three-Mile Island.

The concluding statement that

"nobody" will police the world's reactors is, at best, an indication that the author didn't look very hard, or is attempting to scare your readers. Had he bothered to ask anybody in the nuclear industry or regulatory agencies, he would have learned that IAEA (International Atomic Energy Agency) was formed years ago to "police" the concerns he mentions. In addition, the International Nuclear Fuel Cycle Evaluation (INFCE) committees have been investigating for the last two or three years the controls required for further international development of nuclear power.

T.E. DUNN
RICHLAND, WASH.

PM feels that "not taking the Three-Mile Island accident seriously" and broadcasting that the incident was the result of a conspiracy among the U.S. oil companies—as was done in Moscow—are two very different things.

As far as the IAEA and INFCE are concerned, we would suspect that their influence on nuclear power processes within the Soviet bloc amounts to something far short of "policing."

Sharp-eyed reader

In the *It's New Now* item "Shock Absorber For Light Bulbs" (page 81, Aug. '79), the picture of the socket implies the Bulb-Miser can be used in a three-way socket. But such use would short the two center contacts and light both bulb elements. Bulb-Miser shouldn't be used with three-way sockets.

MARTIN BURT
ELLWOOD CITY, PA.

Reader Burt is correct, although Bulb-Miser's manufacturer does point out that it will work in a three-way socket if a regular bulb is used.

Corrections

The Dobbins power sprayer shown in PM (page 86, July '79) is manufactured by Master Manufacturing Co., 119 Main St., Box 694, Sioux City, Iowa 51102.

Also, we apologize to any of those readers who might have been misled by the *PM Workbench* item, "Porcelain Touch-Up Kit," which appeared in the June issue (page 71). The \$3.33 price buys only one color, not all nine.

PM



FESTIVE EVENINGS
OFTEN START WITH RED.

JOHNNIE WALKER RED
THE RIGHT SCOTCH WHEN ALL IS SAID AND DONE





NOTES FROM THE EDITOR

John A. Little



Judges place grand-prize ribbon on a classic acorn bed made by winner in the 9th and 10th grade division of Stanley's Woodworking Scholarship Contest. PM's Harry Wicks is second from right.



PM's several million woodworking readers are familiar with the first-class fare that Harry Wicks (left), Home and Shop Editor, brings them each month. This issue features another real bonanza of projects developed under Harry's guidance. And it surprised no one this year when Harry was asked again to

help judge what may be the nation's best-known woodworking competition: The National Stanley Woodworking Scholarship Contest for high-school students. Other judges (photo): Pamela Argosy, head of interior design, B.C. Porter Sons; Richard Hastings, president, Stanley Tools; Jephson O'Connell, director, Interior Design Studio, G. Fox and Co.; Herbert Siegel, director, industrial arts and vocational education, City of New York; Wicks; and Paul Muenzen, Stanley Tools.



The three or four ex-military pilots in PM's crew—each of whom spent many hours of young manhood acquiring his flying skills—were much amused at a set of flight instructions we ran across recently. Reader H.V. Lindbergh called our attention to a booklet made up from articles published in *Popular Mechanics* in 1918 and titled *How to Build a Scout Monoplane* (drawing, above). Concluding 24 pages of construction details is one paragraph—90 words—of flight instruction. Our favorite line: "Don't try to get off the ground more than 10 or 15 ft. the first month." Seems safe enough, but it must have been pretty exciting for occupants of nearby homes.

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Street car you'll desire is named Montage. Fiberglass body is on unshortened Beetle chassis.

Do-it-yourself dream car

It looks like a low and lunging Can-Am racer but the headlights give away the fact that it's street legal. It looks like an impractical fuel hog, but the thrashing sound from the rear of the car identifies it as VW-Beetle powered.

It's got the feel of a \$20,000 Gran Turismo, hand-built somewhere south of the Italian Alps, but the Montage nameplate tips you off that it's a sports-car kit from Manta Cars in Costa Mesa, Calif.

The Montage is a recent addition to the home-garage genre of cars that go together without the need of a mile-long assembly line. Instead, it's put together with the tender loving care that only you, the builder, can provide.

The VW chassis that mounts the fiberglass Montage body is used as is—not shortened by taking out a section and using up your time and energy.

The \$6400 kit includes all body panels, doors, windows, weather stripping, gauges and parts, but doesn't come with the Beetle chassis and its wheels, tires and engine. A stripped kit is available for \$4000, and for \$7000 Manta Cars will provide the Montage sports car completely assembled.

Anyone up to 5ft., 10 in. will fit into the 1700-pound Manta; if you're as



Montage engine cover, doors open wide.

tall as 6 ft., 4 in., a seat-lowering kit will provide sufficient leg and headroom. Manta Cars is located at 3303 F-6 Harbor Blvd., Costa Mesa, Calif. 92626.

Ragtop resurgence



Ragtime Mini makes convertible of LUV.



Trans Am: converted by American Clout.

New cars and trucks whose tops fold down are popping up all around. No sooner were we in print with *Return of the Roadster* (page 62, July '79), than we caught wind of more activity among those who specialize in the art of topehopping.

One of the neatest conversions—minipickup to convertible—is being done by Ragtime Mini in Studio City, Calif. They've got the market sewn up for high-quality work that cuts off your pickup's roof and replaces it with a heavy vinyl top and integral Plexiglas rear window. The complete job runs \$800, but

costs less if you go with just the vinyl top and cut off the roof yourself. Ragtop Mini, Box 1407, Studio City, Calif. 91604, can provide installation information.

Pontiac's Trans Am is already the hot-set-up muscle car among young car nuts, but wait'll they see the convertible version. It's not from Pontiac, of course, but from American Clout. It's the best-looking droptop from the Clout shop, which also converts Camaro Z-28s and Mustangs. American Clout is the worldwide distributor for National Coach Engineering Ltd., and it's headquartered at 446 South Winchester Blvd., San Jose, Calif. 95128.

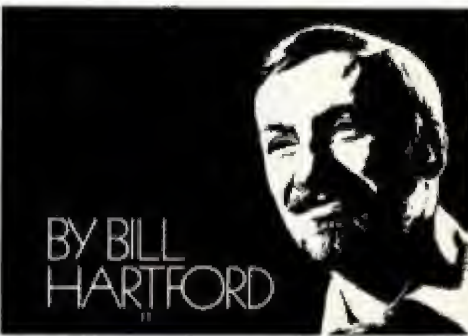
We just heard that a U.S.A. Convertible Club is being formed to provide convertible owners with parts-location services, tech tips, resale info and social events like rallies and parades. Write the club at Box 423, Annapolis, Md. 21404.



Jetta is name of new Rabbit variation.

Rabbit hutch

Next month, Volkswagen's Rabbit convertible should start arriving here from the Karmann coachbuilders in Germany. At the same time—only in Europe, however—the notchback version of the Rabbit (called Golf in Europe) will be hitting the road. Jetta is the name of this other variation of the car that the New Stanton, Pa., plant can't build enough of. The Jetta will join the lineup of U.S. Rabbits sometime next year. By then, still another Rabbit version—the pickup truck—will be coming out of the Pennsylvania plant. That's not a factory. It's a breeding ground! **FM**



BY BILL HARTFORD

PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

Blue-streaked pine

Blue-streaked western pine with a marble look is appearing in lumber yards across the country. It comes from trees killed by drought or pests while still standing in the woods.

The color in no way affects the strength of the wood, reports the Western Wood Products Assn. Nor does it affect paint-, glue- or nail-holding qualities. It's used as wall paneling, for furniture and as framing lumber.

The stain—not to be confused with decay—is caused by a fungus that lives on the water-soluble materials in unseasoned wood and dies when wood dries. It doesn't live on cellulose or lignin, which comprise wood's structural components.—*H.W.*

Drive brads safely

The brad squeezer drives brads into picture frames without nicking the frame, breaking the glass or bending the brads. Just lay the brad in place and use tool to force it into the frame molding with an easy squeeze



Use brad squeezer to drive brads safely.



Position jaws to hold brad, then squeeze.

of the handles. A cushioned jaw pad protects the edge of the frame while you squeeze. It's \$20.90 postpaid. Brookstone, 493 Vose Farm Rd., Peterborough, N.H. 03458.—*H.W.*

Dehumidify damp closets

Help dry closets that are subject to moisture with the Damp-Chaser electric dehumidifying rod. It continuously warms air to protect against mold, mildew, rust and musty odors. When rod is placed near bottom of closet, it promotes



The electric dehumidifying rod warms air.



Place the rod on or near the closet floor.

circulation by warming surrounding air, which then rises. Model 7C shown is 36 in. long and priced at \$14.95 postpaid from Damp-Chaser Electronics, Box 1610, Hendersonville, N.C. 28739. For large closets, use two units.—*Julius Spedale*

Handy hex-key tool

The Perry Wrench is designed to remove or install Allen-head bolts. It is available in a number of metric sizes from 3- to 8-mm-dia. hex rods and in standard sizes from 1/8- to 3/8-in.-dia. hex rods. In all but the smaller sizes (3,4 mm; 1/8, 5/16 in.), the cross-



Crossbar locks at center (A) or side (B).

bar locks in three positions: center (A), or for greater torque, right (B) or left side. Wrenches are priced from \$3.23 to \$4.15 postpaid by Perry Wrench Manufacturing Co., 1705 Stuart St., Berkeley, Calif. 94703.—*H.W.*

Time to get organized

A new kit is being offered by Dremel that includes its Moto-Tool, 20 tool accessories and an 11-drawer workshop organizer. The organizer is made of steel with transparent plastic drawers to locate stored parts fast. Its compact size (5 1/2 x 6 x 12



Organizer stores Moto-Tool, accessories.

in.) makes the unit easy to store or transport. Model 2712 kit is ticketed at \$68 and is available at hardware and hobby stores. It's manufactured by Dremel, Div. of Emerson Electric Co., 4915 21st St., Box 518, Racine, Wis. 53406.—*H.W.*

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

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PM LOOKS AT GLASS ETCHING KIT



Author's first try at using glass-etching kit produced this elegant design on a serving tray. The etching solution can be used on glass or glass mirrors only. Be sure not to use it on plexiglass, plastic or Pyrex. You should practice etching on a scrap piece of glass first.



Kit contains cleaning and etching solutions, brush applicator, patterns and a pair of plastic gloves (not shown).

Anyone can master the craft of glass etching with the new Armour kit. The steps are simple: First clean glass with cleaning solution. After drawing or tracing a pattern on a sheet of adhesive-backed vinyl film (Con-Tact A-21 brand plastic is recommended), apply it to glass. Avoid air bubbles under film. Next, using a sharp hobby knife, cut out and peel off areas to be etched. Brush on etching cream and allow to sit for 10 minutes. Finally, rinse, dry and clean finished etching thoroughly. *Cautions about rinsing:* Do not rinse etching cream repeatedly into porcelain or enamel sinks. Do not rinse near food-preparation area.

The kit is available from Armour Products, 31 Hill St., Midland Park, N.J. 07432. Postpaid price is \$10.95.—R. Capotosto



French curve was used to create pattern on Con-Tact vinyl film sized to glass.



After Con-Tact is adhered to glass, use sharp hobby knife to cut out shapes.



After peeling away shapes, apply etching cream to the glass. Wear plastic gloves.



Safest way to rinse away cream is outdoors with a hose. See cautions in text.



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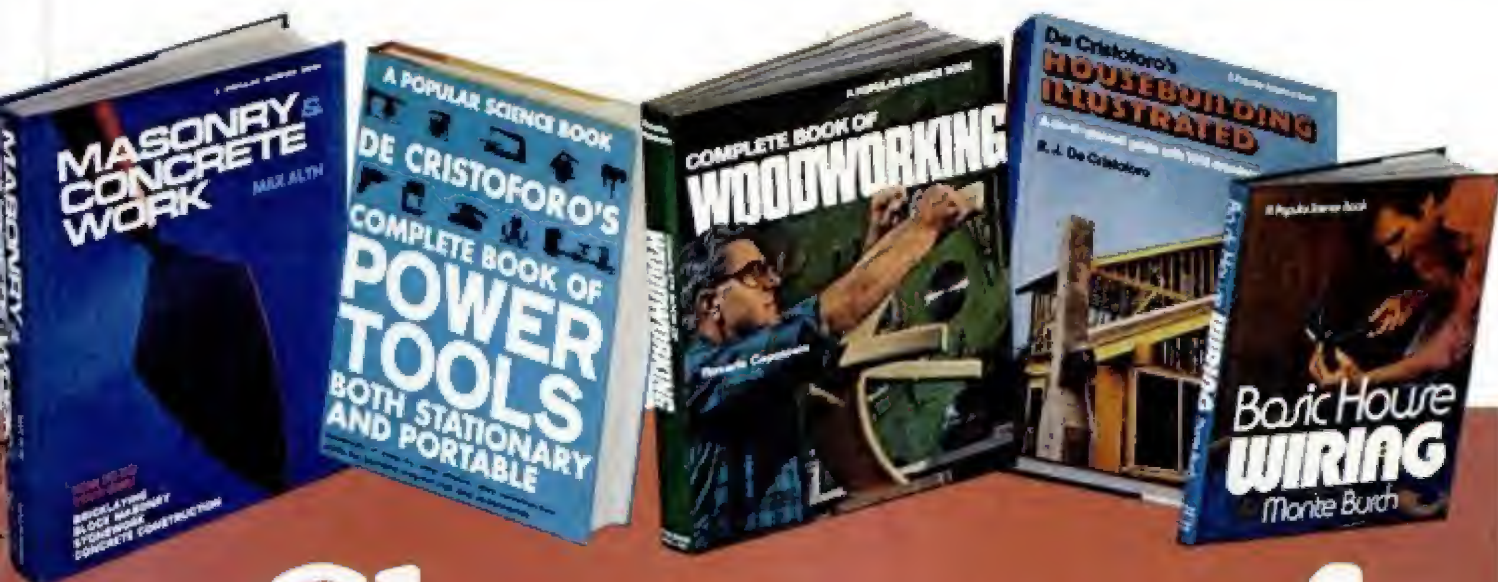
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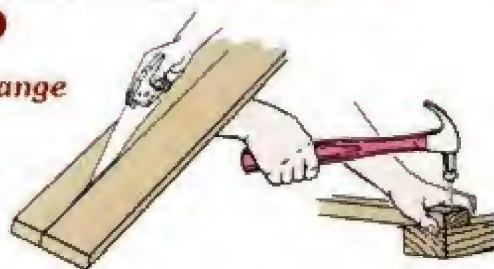


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HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Toilet-bowl seal

I have had unbelievable difficulty in installing a wax seal under my toilet bowl, as suggested in Homeowners' Clinic, page 72, Feb. '79. This type of seal was replaced long ago by a foam-rubber seal, which is easier to use and can be used over and over. I'm not a plumber, but a "thinking" do-it-yourselfer. P.S. I'd be lost without my PM.—Donald J. Waldbilling, St. Paul Park, Minn.

You are right on two counts. There are other devices, and you are not a plumber. Not only have my ancient hands replaced many wax seals, but a check with six plumbing contractors indicated that they still use them.

There is a seal that incorporates a polyethylene shoulder for those who have difficulties as you do. It's called Harvey's No-Seep No. 1 Wax Toilet Bowl Gasket and is manufactured by William H. Harvey Co., Omaha, Neb. 68131. These seals cost about 65 cents, so you don't really need to reuse them.

Loose floor bridging

The carpenters who built my house neglected to fasten the floor bridging before they fastened the subfloor. The joists are 2x8 in. at 16 in. on center. Have you an innovative method or material for correcting the situation?—Edward J. Mavec, Newark, Ill.

I take it that you're referring to a first floor condition with bridging visible from the basement, since you know that the bridging bottom wasn't nailed. If you have 1x3-in. cross bridging and it's only nailed at the top, the carpenters did you a favor. They just didn't finish the job. The bottom isn't supposed to be nailed until the flooring is in place. Just go to the basement and nail the bottoms of the bridging to the joists, using 8d common nails. Push bridging snug against joists beforehand.

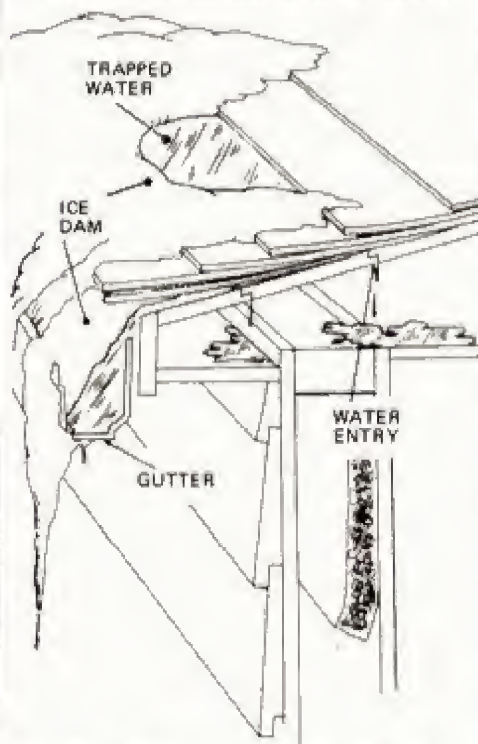
For any homeowners who don't have bridging, cut lengths of 2x8 in. stock to fit tightly between the joists at the mid-point of the joist span. Then toenail the solid bridging with 10d nails.

Ice-dam damage

Our walls and ceiling get water damage when the ice backup in our gutter melts. We've heard about heat tapes. Someone also suggested an attic fan,

which would be activated when the humidity reached 70 percent. Which do you recommend?—R.D. Lewis III, St. Louis.

I believe you're talking about two different problems. First, the only certain cure for ice backup, short of removing your gutters, is to use heat tapes. This keeps the ice from backing up under the shingles, causing a water leak as shown in the drawing. See "Tape for Gutters" (*Homeowners Clinic*, page 40, Oct. '78) for information on heat tapes.



Ice dams build on roofs, causing leaks.

Now to the second problem. If you have condensation on the underside of your roof sheathing, it may be that moisture is rising through the ceiling of the top floor and reaching the attic. You can reduce the amount of moisture that reaches the attic by adding a vapor barrier. To install one now, staple it over the existing ceiling of the top floor, then apply another layer of plasterboard.

An alternative to adding the vapor barrier is to paint all ceilings

with a prime coat of aluminum paint and two coats of vapor-resistant oil paint. See "Humidity and Insulation" (*Homeowners Clinic*, page 12, Dec. '78) for more information.

With the proper ventilation you can remove moisture that does reach the attic. This will include a fresh-air intake ventilator, such as soffit vents, and a moist-air outlet, such as a power roof ventilator.

To find out how much ventilation your house needs, determine the square footage of your attic floor and the approximate clear opening of the ventilator through which air moves. The ratio of free area to attic floor space should be 1 to 150. If the ceiling of your top floor has a vapor barrier, or if half the ventilating area is served by ventilators in the upper part of the space, the ratio can be 1 to 300.

As your friend suggested, a power ventilator can be equipped with humidistat to actuate the unit and remove excess moisture in winter.

Spalling brick

Some of the bricks on my veneered house are spalling off close to the ground, in 1/8- to 1/4-in. pieces. I've also noticed that my foundation sweats in the winter and that my crawl space is warm. Should I insulate my ductwork?—Harry Harts, Ellsworth, Kans.

Insulating ductwork in a crawl space is a must for two reasons:

1. In this day of the energy crunch you shouldn't be losing B.T.U.s to your crawl space through uninsulated ductwork. When you insulate the ducting, also insulate the floor above it to prevent cold feet.

2. Moisture collects on cold window panes in a humid, heated room, and, similarly, concrete sweats. This moisture seeks drier, cold outside air through the concrete and brick. When water freezes in the brick pores, the bricks will spall. **PM**

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.





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I'd like to give you and your family a suggestion based on something we do in our family. Find an old picture frame. Or an old mirror. Or a small table. It doesn't matter where you find it—though it sure would be nice if you can poke around the attic or the basement and find something that belonged to your grandfather or grandmother.

Next, refinish that piece and put it under the tree. Now before you tell me refinishing is a sloppy, time-consuming business, let me stop you. Have you heard about my furniture refinisher?

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DETROIT LISTENING POST

GM 'L' cars canceled

General Motors has scrubbed plans to market two separate versions of the '82 front-drive Monza-series replacements scheduled for spring, 1981 introduction. Chevy and Pontiac were slated for 101-in. wheelbase econocoupes (called "J-cars") to supercede their Monza and Sunbird, while Olds and Buick would get shorter, sportier 97.5-in.-wheelbase ("L-car") Starfire and Skyhawk replacements. The latter pair were to be built by GM affiliate Isuzu in Japan and imported here. The former are variations of a planned front-wheel-drive "world car" to be produced in GM plants in the United States, Japan, Germany, Australia and Brazil.

The new streamlined program, designed to save money and bring fuel-efficient domestic cars on-stream as soon as possible, calls for the two "senior" divisions to inherit their own versions of the basic Chevy/Pontiac J-car, with as much common componentry as possible to keep costs down. The Isuzu-built L-cars were intended to compete against the likes of Datsun's 280-ZX and Porsche's 924, but sources say the longer J-cars are no slouches themselves, with sleek, exciting styling and excellent front-drive handling. They should have no trouble carrying their weight in the mid-'80s sporty subcompact market.

Diesel list growing longer

Flying in the face of stricter emissions standards for diesel engines, domestic and foreign automakers are moving forward with diesel development programs while crossing their collective fingers in hope of more reasonable regulations.

Oldsmobile, already producing 5.7-liter and 4.3-liter diesel V8 conversions of gasoline engines, is planning all-new V6 diesels for '83-model GM cars and trucks. Chevrolet plans to be building its own four-cylinder, six-cylinder and V8 clatter motors by 1982.

Ford Motor Co., which has held off on diesel development while working on its fuel-efficient PROCO (Programmed Combustion) gas-engine concept, has struck a deal with Cummins Engine Corp. to develop a turbo diesel for 1983 in case PROCO isn't ready by then. Ford is also shopping in Europe and Japan for a

suitable small-displacement oil-burner for use in future small cars.

Chrysler confirms that work is progressing very well on its own six-cylinder and V8 diesels. "You'll see us in diesels as that market matures," says Hal Sperlich, executive vice president for engineering and product development. American Motors is looking at diesels (as well as turbocharged versions) from both Renault of France and Isuzu of Japan for future Jeep and passenger-car applications.

Volkswagen, of course, is selling all the diesel Rabbits and Dashers it can import and began installing the fuel-thrifty engines in U.S.-built Rabbits this fall. Now we just have to see where the government takes us with those exhaust-emissions standards.

Future shock

First they did away with the points, and now they want to eliminate the distributor entirely. Motorola's Automotive Products Div. is supplying Citroen of France with all-electronic, spark-timing modules with no moving parts at all. These are presently being used only on Citroen's "el cheapo" two-cylinder econocars, but there's no reason (they say) why the same concept can't be applied to multicylinder engines.

While "black box" distributors may still be a few years away in domestic cars, something else we have always taken for granted already is on the way out. The conventional spare tire is going the way of the dinosaur and 10-cent coffee, at least in most domestic automobiles, having been replaced by smaller, more compact temporary spares. The reasons are to save weight and add cargo space, and the most common type is a compact, high-pressure (up to 60 pounds per square inch) spare that works quite well—but only for a limited number of miles. The old inflatable spare introduced in the 1960s is also still around, available as an option in many cars. Tiremakers predict, however, that standard road tires will have run-flat capability by the mid-1980s, which will eliminate the need for even temporary spares.

Rust warranties

Last July Ford Motor Co. joined American Motors in offering a

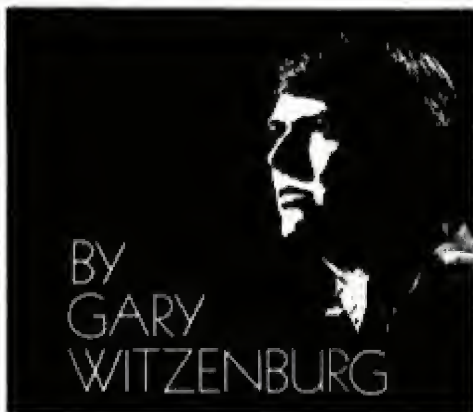
three-year, unlimited-mileage rust warranty on all 1980 Ford and Lincoln Mercury cars and light trucks. Under the warranty, "any part which in normal use develops perforation from corrosion within three years of retail delivery or first use will be repaired or replaced free of charge after inspection by a Ford Motor Co. representative." All cars sold in Canada currently must have such a warranty, and perhaps by the time you read this, GM, Chrysler, VW and many imports will have similar programs in effect for their U.S. models.

More pet peeves

Reader R.E. Welsh of Utica, N.Y., writes to add his own pet peeves to the list we put together last April. Among other things, Welsh is annoyed by the removal of roof drip rails (rendering useless his rail-mounted ski and boat racks), the "peanut-sized" glove box, the lack of a rear-window washer/wiper, the quality problems with such things as power windows, power door locks and door fits, and the ineffectiveness of the windshield defroster on his 1979-model Ford full-size station wagon.

To add one more of our own, we can't understand why some two-door-car front seatbacks are designed so they won't stay forward when you're loading things into the back-seat area. GM's X-cars have this problem, and so do the Camaros and Firebirds, which (to make things worse) also retain the old "Nader" latch that must be released again after the thing snaps back into place. Ford's Mustang and Capri, on the other hand, have inertia-type seatback locks, and their seats will stay put when they are folded forward.

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PM ELECTRONICS MONITOR

Country of the blind

Industrial robots, the kind that now "man" many assembly lines, can mangle, crush or simply smash parts if the robot arm makes a wrong move. Not only are the robots somewhat stupid—they are totally blind.

Now the National Bureau of Standards has a solid-state television camera "eye" for these assembly-line behemoths. The camera is mounted on the robot's "wrist" so that it can see between the two fingers of the robot's "hand."

The view of objects in the line of sight is presented as a narrow line of light. From the line's position and its apparent shape, the robot can figure how far away the object is and its angle and orientation. If needed, the robot arm can reposition itself.

The eye is still primitive—but there is some light at the end of the tunnel!

8-tracks: Full circle?

Before the cassette, the 8-track cartridge reigned supreme. Now, the 8-track is considered a poor second choice to the cassette—but things may change due to a new invention, the reversible 8-track cartridge.

Until now you could not rewind an 8-track cartridge. To hear a song again meant listening to some other tracks you might not want to hear. No wonder the instantly reversible cassette took over the field!

KRS Magnetics has redesigned the 8-track cartridge to be rewindable. Take it out of your 8-track deck and you see a white, indented button on top. Twirl the button to rewind the tape. Right now it requires muscle power, but the hope is that new 8-track decks will be designed to automatically reverse at the push of a button using this system.

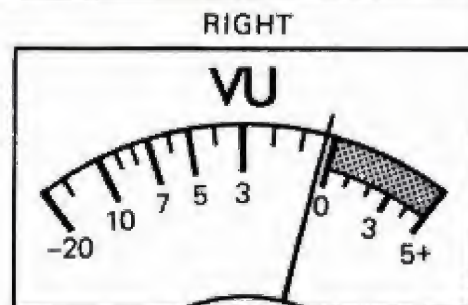
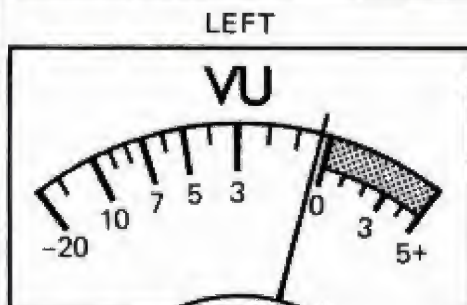
KRS Magnetics (1 First St., Los Altos, Calif. 94022) obviously hopes this will be the future of the 8-track—the future of which has looked pretty bleak recently.

Think thin!

An electronic device such as a calculator or a watch requires a power supply—a battery. Batteries are often the largest part of some of the new, miniaturized units. Now, batteries are thinner than ever.

Panasonic recently announced an ultrathin "paper" battery that can be manufactured in just about any almost-two-dimensional shape.

We think that once design engi-



How to use VU meters

If you have a cassette deck hooked up to your hi-fi, it's a good bet the deck has two VU meters right on the front to help you record. However, many people who think they know how to use the meters are not getting the best results!

VU (or volume unit) meters are marked off in decibels. A decibel is a handy way of measuring ratios of sound. If a sound increases by 3 decibels, it doubles in volume; a 6-decibel increase will quadruple the sound; 12 decibels increases the level 16 times, and the progression continues.

You will note that most VU meters are marked with red at the high point of the scale. Sure enough, that's the distortion point.

Many people "ride herd" on the gain controls, keeping the needle below this point. That's the wrong way to do it!

Listen once all the way through the selection you want to record. Find—for each channel—where the loudest continuous sound is. A cymbal crash doesn't count, but a long fortissimo does.

Adjust the gain so that, at that point, the needle hangs just below the red. Sure, transients will send it above the red line, but only momentarily.

Set it and forget it? No, you should monitor the recording to make certain everything goes well, but you should not have to spend your time tweaking the gain control.

neers get hold of these (and perhaps similar batteries from other companies if they become available), there will be a whole new level of miniaturization of consumer electronics.

From breadboard to PC board

Our project *Guard Your Battery With PM's Charge Checker* (page 84, May '79) was many people's intro to the world of plastic-breadboard design. A plastic breadboard, as used in Charge Checker, lets you build without soldering. One drawback—it is less durable than a printed-circuit (PC) board and not as easily reproduced.

Continental Specialties has met the challenge with their new, three-part system. First is a paper pad, the sheets of which are printed to look like plastic breadboards. This lets you design without actually having the parts in front of you. Then comes the plastic breadboard we already know, so you can plug in the parts and see if the project really works. The third stage is a copper-clad PC board; the copper reproduces the hole pattern of the plastic board. Solder, and you have a permanent project.

You can get more info on the system from Continental Specialties, 70 Fulton Terrace, New Haven, Conn. 06509.

Take that, Klingon!

We said that a *Star Trek* game for

home computers struck us as one of the best in our *Games on Computers* (page 69, Aug. '79). Since then, we have been inundated with various programs.

Two really impressed us: *Time Trek* from Personal Software (592 Weddell Dr., Sunnyvale, Calif. 94086) and *Super Star Trek* from Programma International (3400 Wilshire Blvd., Los Angeles, Calif. 90010).

Time Trek is a real-time game for the Pet and TRS-80 home computers. The bad guys, called Klingons, don't wait for you to make your move if you dither—they just swoop right down on you! It can be very nerve-racking.

Super Star Trek is less a thinking game and more reflex-oriented. It uses the Apple II computer to produce realistic enemy ships. In fact, the graphics are excellent.

After all the practice I've had, I feel like enlisting in Starfleet! **PM**



Cordless Wonder

For \$89.95 the Mura cordless telephone sounds like a bargain. But wait until you hear about its many disadvantages.



The Mura cordless telephone represents a major breakthrough in telephone technology.

It's about time. For years you've seen ads for cordless telephones selling for between three and four hundred dollars.

Now through some very clever planning and a sprinkle of new technology, Mura Corporation has come up with a cordless telephone that sells for \$89.95. However, it has major disadvantages that could totally discourage you from buying the system—but more on that later.

ONLY IN AMERICA

The Mura weighs only 12 ounces and measures 1½" x 2¼" x 6½". The system includes a base unit that plugs into your telephone jack. You carry your cordless telephone with you and when your phone rings, you press a button and answer. And you can talk to anyone as long as you remain within 400 feet of the base unit.

But wait. We mentioned that the phone had major disadvantages. And it does. But first, let's outline some of its major advantages.

Convenience You don't need an extension telephone. With the Pocket Phone you have an extension phone that you can take with you—in the bath, in the den, in the garden, or to your neighbors.

Intercom You can use the base unit to page the person holding the cordless telephone. For example, if you're in your office and someone outside has the unit, you can press a button on the base unit and buzz the portable phone—just like on an intercom. Simply by talking on the phone plugged into your base unit, you can talk with someone on the remote phone. It's ideal for home or factory use.

Price The cost of the Mura remote telephone is only \$89.95. Compare this price not only with the cost of other \$300 remote telephones but with conventional phones as well, and you can appreciate what a major breakthrough the Mura system represents. But there's more.

You can plug any conventional phone into the base unit and carry on a three-way conversation. You can answer a call at the base unit and signal the remote unit to pick up the line. You can cut out the remote phone from the base unit if you want to keep a conversation private.

TALK OF VALUE

You can carry the cordless telephone with you with its antenna collapsed and the battery on standby. When a call beeps your unit, you simply extend the antenna, turn the power on, and start to talk.

The unit is FCC approved for connection directly into your telephone line. If you don't

have a four-pronged jack or a modular connector, simply call your telephone company. They'll promptly install a jack for you and the cost will be around \$15 or less depending on your location.

NOW THE CATCH

We mentioned that there was a catch—a few major disadvantages that you, as the consumer, should know about before you consider purchasing this product. Here they are:

Forget About Dialing The new Mura Pocket Phone can't dial out. It only receives calls. To many people, this doesn't matter because 90% of remote phones are used to receive calls and not to place them. By eliminating the dial, Mura has cleverly saved consumers hundreds of dollars.

Forget About Steel Walls The Mura unit won't penetrate them. This means that if you want to use your phone in a factory with metal walls, your unit won't work. But for most factories and practically all homes, the unit is ideal.

Forget About Snooping The unit has only a 400 foot range. At first this might seem awfully short, but nobody can snoop in on your conversations if that person is beyond this range, and 400 feet is more than enough for most applications. Most cordless telephones operate in the 27 megahertz range—the same frequency area used for citizen band radios.



The base unit for the Mura can also be used as a personal paging system or intercom.

The Mura uses the 49 megahertz range. This frequency has clearer reception with practically no interference.

The above are the disadvantages. For 90% of you, they don't mean a thing. For those 10% of you who need a dial, we would recommend the more expensive cordless telephones.

But for those of you who will accept its disadvantages, you'll be in store for the greatest idea in telephone convenience since the

cordless telephone was first introduced. In fact, rather than install an extension phone, why not consider the Mura instead?

TRY IT FIRST

We suggest you try the Mura Cordless telephone system in your own home, office or factory. Use it for 30 days. Take the phone to your next door neighbor's house or with you to the bathroom while you take a shower or bath. Take it with you on your patio or balcony, or bring it in your garden as you work. Use it in your factory as an intercom or in your office as a remote telephone.

After you've given it a thorough test, then decide if you want to keep it. If not, no problem. Simply return your system for a prompt and courteous refund including your \$3.50 postage and handling. You can't lose.

HERE'S THE WAY

To order your unit for a 30-day test, simply send your check for \$89.95 plus \$3.50 postage and handling to JS&A Group, Inc., One JS&A Plaza, Northbrook, Illinois 60062. (Illinois residents please add 5% sales tax.) Credit card buyers, call our toll-free number below. We'll send your base unit, cordless telephone, rechargeable batteries, recharger, complete instructions, our 90-day limited warranty, and the address of the closest Mura Service Center or service-by-mail station.

Your unit is backed by Mura Corporation, a 17-year old company famous for their microphones, headsets, and other audio products. JS&A is America's largest single source of space-age products—further assurance that your modest investment is well-protected.

Very often when a product's disadvantages aren't made clear to the consumer, that product ends up being a disappointment. By explaining the major disadvantages of the Mura cordless telephone, not only are we avoiding a possible disappointment, we're proving just how great a product it really is. Order a Mura cordless telephone at no obligation today.

JS&A PRODUCTS THAT THINK®

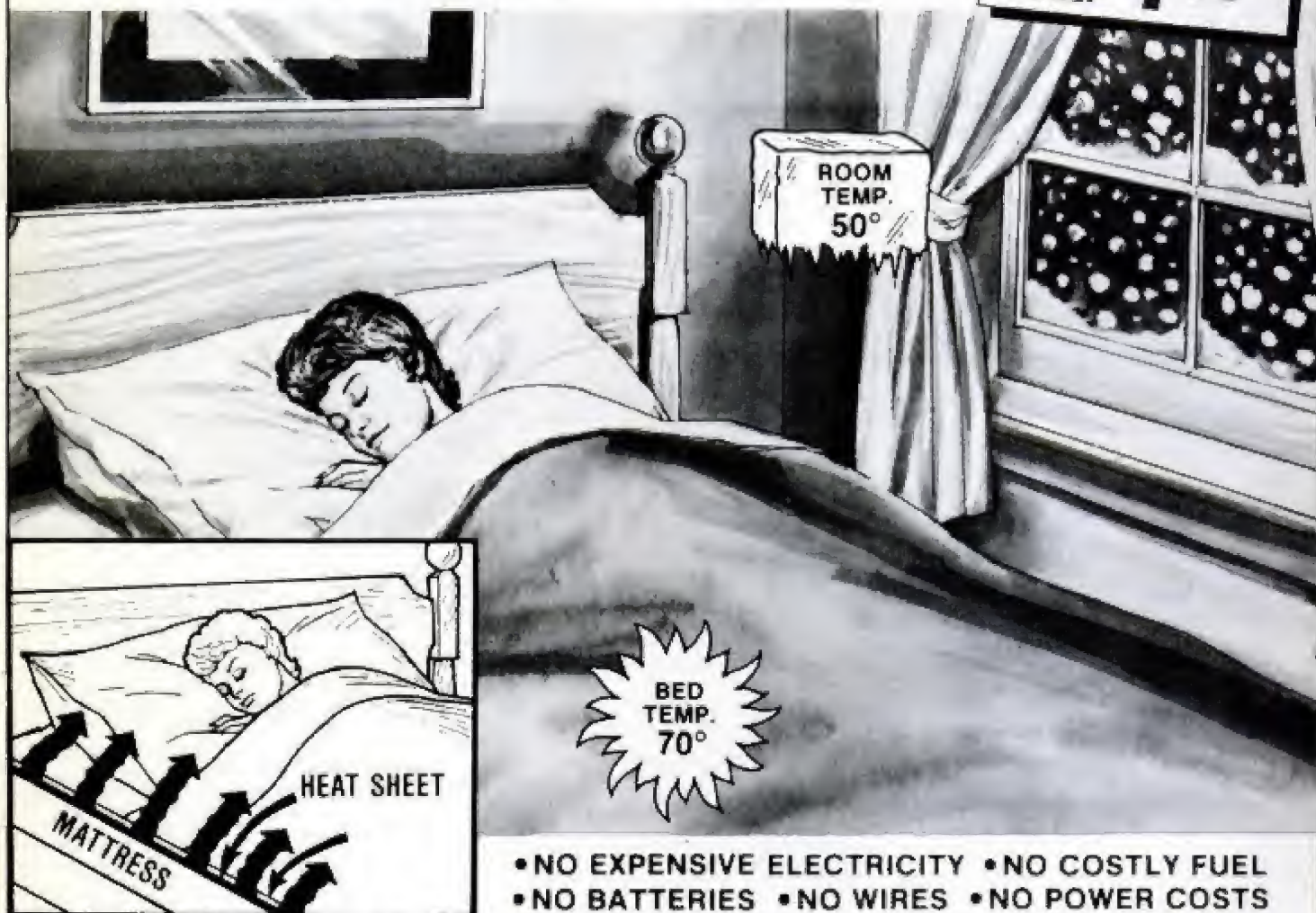
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THERMALUM HEAT SHEETS are stain resistant and can also be used as a mattress pad. Make sure every size bed in your house has one. Try the **THERMALUM SHEET** and stay warm every night while your thermostat is turned down. Prove it without risk. If you're not warmly pleased, return it within 14 days for your purchase price refund (less postage & handling, of course). **THERMALUM HEAT SHEETS** make wonderful house-warming gifts, too. Special savings on extras. Order today and take advantage of our **FABULOUS PRICE BREAK!**

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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Traveling tool case



This tool case is a good traveler.

A few weeks ago, the thermostat froze shut on the family Dodge. Lacking a screwdriver and 9/16-in. socket, I waited four hours in the mountains for a Triple A rescue.

Never again. Next day I bought a Granny tool case and have stocked it with a few simple hand tools. The case, made of tough vinyl by H&L Products, cost \$3.99. It keeps my tools from rattling and makes them easy to store in the tire compartment. I figure it's good insurance.

The Granny tool case, Model 211, is available at most auto stores. Or you can order one directly from H&L Products Inc., Box 1445, National City, Calif. 92050.—M.L.

Lube sticker

If you service your own cars, as I do, you probably miss a regulation lube sticker to record your mileage. I used to write the service intervals down in a glovebox log book. But that proved awkward to check.

Recently I noticed that Hollywood Accessories puts out a set of 10 stickers for 79 cents. I keep my mileage in pencil, and use each sticker several times. And since the stickers are on the door, they're a lot easier to check than my log book.

Most auto stores carry them. Hollywood Accessories, Compton, Calif.—M.L.



Good lube reminder.

Fuel-economy monitor

If you're not quite sure how to become an economy driving champ, the Mileage Maker 400 might be just the ticket.

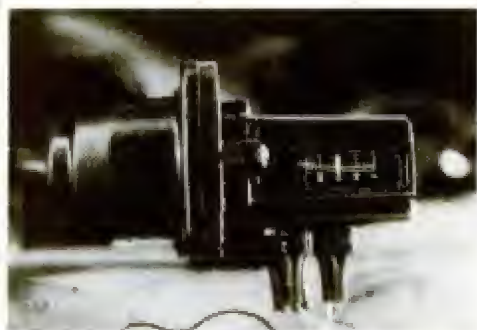
It consists of two basic parts: a vacuum gauge, that you mount under the hood, and a four-lamp display, that fits atop your instrument panel. Switches located inside the vacuum gauge light up the monitor.

The display constantly informs you as to what sort of fuel mileage you're getting—whether good or bad.

The Mileage Maker 400's vacuum gauge can also tell you a lot about the condition of your engine.



Dash-top display gives economy readout.



Vacuum gauge component of the Mileage Maker 400 installs in your engine compartment. Wires run to dash-top display.

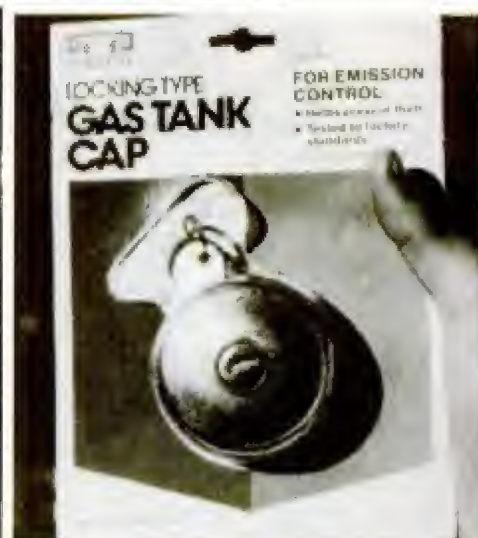
Installation took me about 20 minutes. I used no special tools, and since my car has hidden wipers, I didn't even need to run wires through the firewall.

The price is \$49.95 at accessory stores or, if you wish, order directly from Stromberg-Hydrumite Corp., 2626 West Addison St., Chicago, Ill. 60618.—M.L.

Locking gas cap

The other morning, I found I'd been siphoned. The tank on the family wagon was bone dry. It had been brimful of precious fuel the evening before.

Distasteful as it was, I ran right out and bought a locking gas cap.



Guard your gas with a locking tank cap.

As I did so, I realized I'd waited one tank too long.

Thus, I reluctantly suggest that you might consider such a purchase before your gasoline disappears down someone's siphoning hose.

The cap I bought is a Seal Tite, made by the Allen Group Inc. of California. It has a rubber seal and is just pressed into place (no twisting). I paid \$7.95, but prices vary. Locking caps are available at all automotive stores.—M.L.

Car cancer cure

The old saw, "You can't stop rust once it starts," no longer holds.

Corroseal—a paint-like liquid—converts rust to magnetite and forms a thermoplastic seal to keep the cancerous metal from further rusting.

What's nice about Corroseal is that it can also be used as a paint primer. You wire-brush off the loose rust, apply Corroseal as you would a normal primer, and then paint right over it. Corroseal also prevents the oxidation of other metals.

Corroseal comes in eight-ounce plastic bottles and costs \$4.95, plus \$1.50 for shipping and handling. It may be ordered from Applied Coatings Technology Inc., 1735 Austin Ave., Los Altos, Calif. 94022.—M.L.



Paint out rust.

HOW TO CHECK AND REPLACE GASKETS AND SEALS

by Mort Schultz

Not everyone is equipped to replace a head gasket. But a head gasket is only one of many gaskets and oil and grease seals in a car.

The gaskets and seals you will get involved with most often include the carburetor air-cleaner gasket, carburetor-mounting gasket, manifold gaskets, water-pump gasket, exhaust-pipe flange gasket, rocker-arm (valve) cover gaskets, thermostat-housing gasket, fuel-pump mounting gasket, oil-pan gasket, oil-filter gasket, automatic-transmission pan gasket, and front- or rear-wheel seals (front-wheel seals if car has rear differential and rear-wheel seals if car has front transaxle).

A gasket is a thin sheet of compressible, fibrous material which makes a seal between two metal surfaces to prevent fluid and/or pressure leaks.

The main job of oil and grease seals is different. In practically every instance, it is to protect bearings by preventing loss of lubricant and contamination of the bearing by dirt and water.

In addition to front and rear wheels, seals are found at the front and rear of the crankshaft, in the transmission, at the differential pinion and in the steering system. You will come in contact with gaskets more often than with seals. However, the one seal you encounter in doing maintenance, the wheel seal, is extremely important, since it has a bearing on safety.

Working on front-wheel seals

According to CR Industries, a leading manufacturer of oil and grease seals, safety requires greasing front-wheel bearings (rear bearings in the case of a front transaxle) and installing new seals every 10,000 miles. This interval provides an ideal time for brake inspection.

After removing the outer wheel bearing, lay the wheel (drum brake) or rotor (disc brake) on the floor. Use a drift pin or piece of broomstick and

a rubber or rawhide mallet to gently tap out the old seal and inner wheel bearing.

After servicing bearings and the wheel, install a new seal. Don't reuse the old seal. It usually is damaged when being removed.

A damaged seal causes loss of grease, which deprives bearings of lubricant. Grease can run onto brake linings, causing brakes to grab, which may in turn cause loss of control in a panic stop. A damaged seal also lets dirt and water reach and ruin bearings.

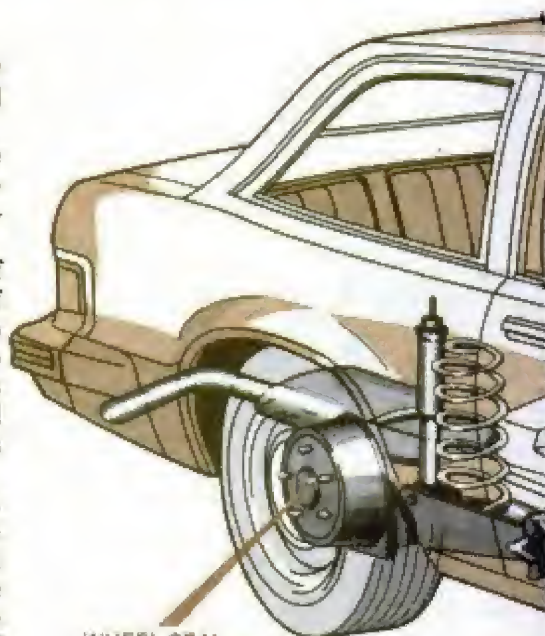
Get the correct seal for the wheel. The part number, embossed on the old seal, may be discernible. It can be used to order the new seal. If the part number is obliterated, tell the parts dealer the make and model of your car. As a precaution, take the old seal with you for matching.

Wheel-seal care may require special seating tool (below). Gently tap tool until seal is fully seated. Before installing, lightly coat the seal surfaces with grease.



After placing the inner wheel bearing back in the hub, lightly coat the sealing lip and outer edges of the new seal with wheel-bearing grease. If you have a wheel-seal installation tool, slip the seal on the tool so that the sealing lip faces the bearing. The side of the seal with the larger opening should be over the tool.

Hold the tool firmly in a straight line and place the seal over the wheel hub. Tap the tool gently until the seal seats. A change in sound as the mallet strikes the tool lets you know when the seal was "bot-



WHEEL SEAL
(IN WHEEL)



WHEEL
GREASE
SEAL

tomed." Don't pound on the tool. You will distort the seal.

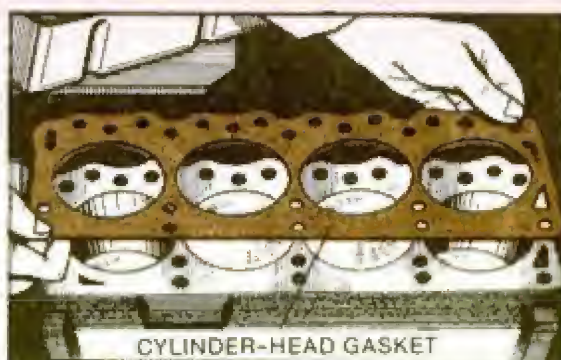
To avoid damaging the seal, it's best to use an installation tool. If you don't have one, use a block of hardwood that is large enough to cover the seal. Hand-place the seal over the bearing. Make sure it's straight. Lay the wood block over the seal and gently tap in place.

Gasket gossip

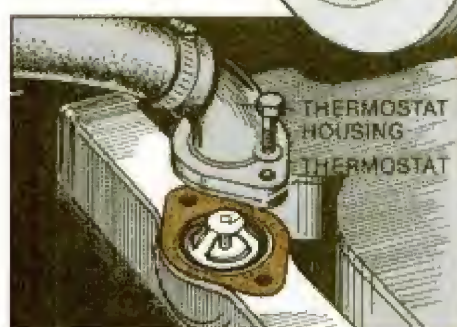
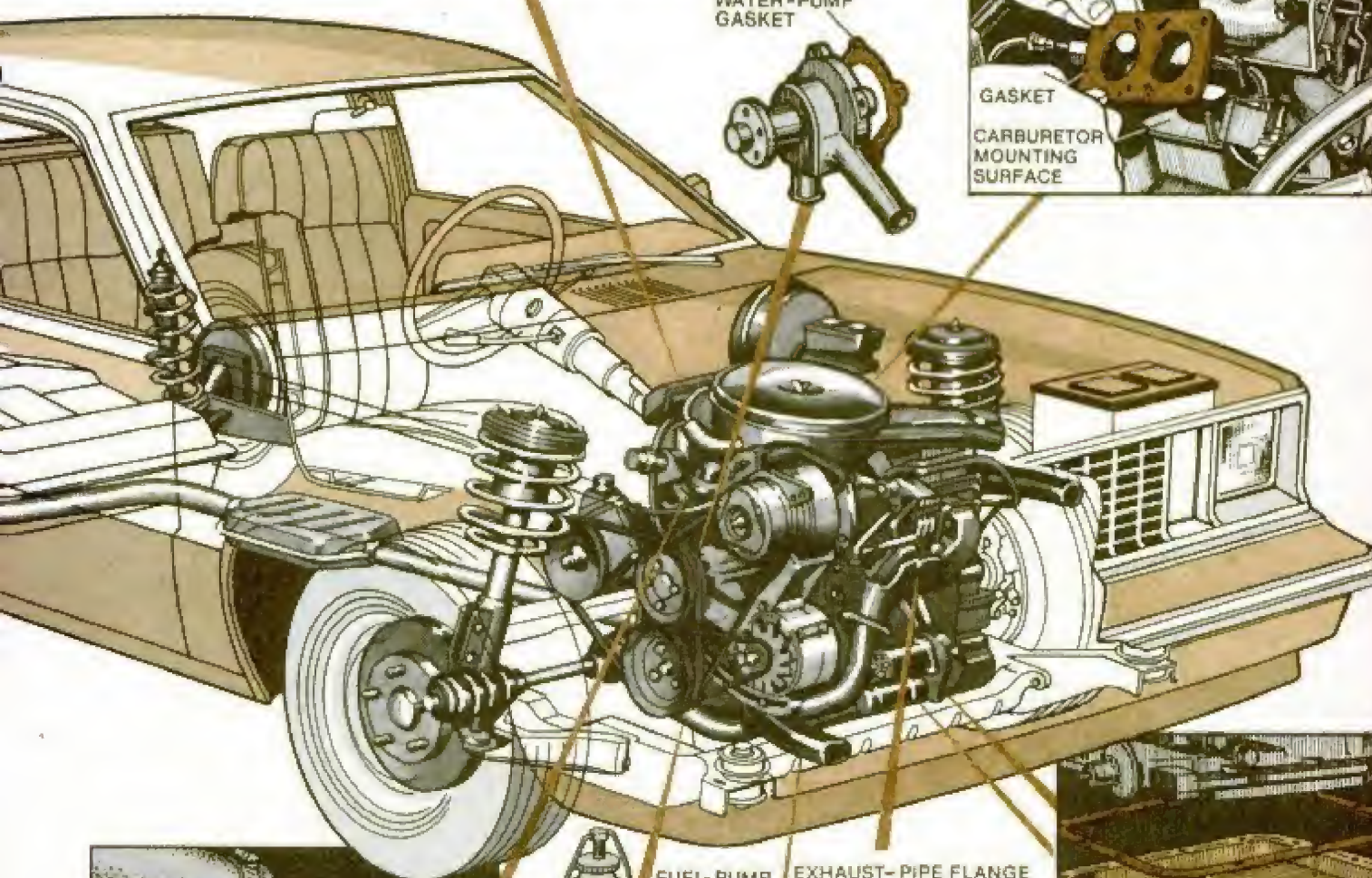
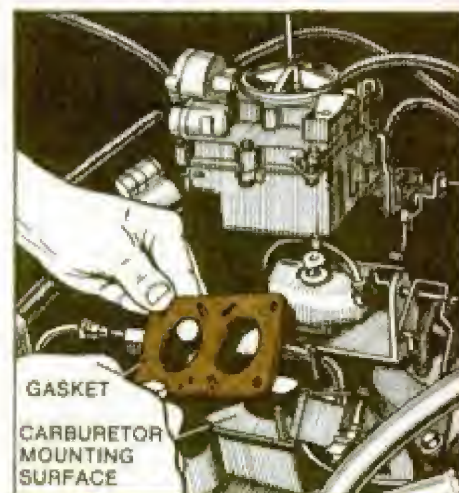
How can you tell when a gasket is shot? That depends on the gasket.

(Please turn to page 32)

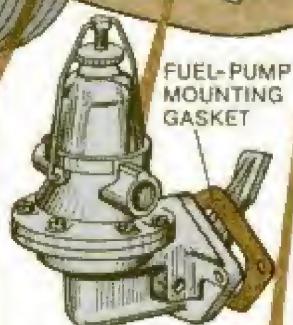
Cylinder-head gasket of your engine must be handled carefully to avoid damaging it. After gasket installation, tighten cylinder-head bolts following proper sequence (see the specifications of the manufacturer).



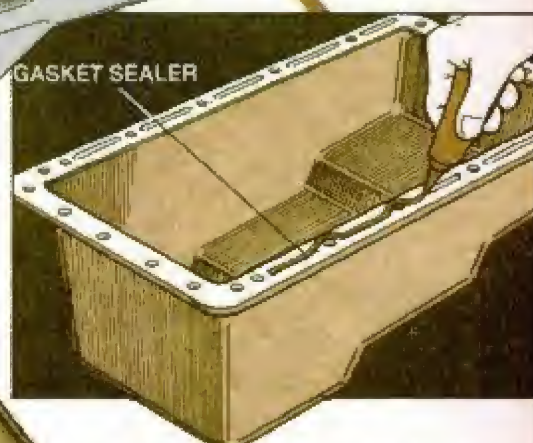
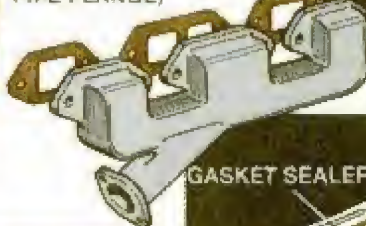
Before replacing carburetor, make sure its mounting surface is free of old gasket material and spotlessly clean.



Thermostat-housing gasket must be replaced every time you change thermostats. When scraping off old gasket material, block off cooling-system passage with a clean rag to keep out particles.



EXHAUST-PIPE FLANGE GASKET (BETWEEN MANIFOLD AND EXHAUST-PIPE FLANGE)



High-temperature, liquid sealer can be used on some cars in place of old, cork gaskets. Check service manual for where it can be used.

With a water pump, for example, coolant will leak past a bad gasket. A consistently low coolant level tips you off even if you overlook wet spots beneath the car. With an oil-pan or oil-filter gasket, you will be aware of oil puddles on the floor beneath the engine or notice the need to add oil frequently.

Different gaskets require different installation procedures. However, some procedures apply to most gaskets, as follows:

- Be sure you have thoroughly clean mating surfaces. According to Daniel E. Zernik, chief product engineer of Fel-Pro Inc., a manufacturer of gaskets, "No operation is more important in gasketing than thorough cleaning. Even the best gasket will have trouble sealing a dirty installation." Use a putty knife to scrape away old gasket material, dirt, carbon and rust.

- Don't re-use an old gasket even if it isn't destroyed during disassembly. Compressibility and resiliency are not the same. A cork gasket can be compressed up to 50 percent of its thickness, but it doesn't have sufficient resiliency to return to its original thickness. Re-using the compressed gasket may well result in leakage.

- Depending on the area, inspect mating surfaces for irregularities and warping. Lay a flat straight-edge lengthwise and then crosswise across the surface. If the straight-edge doesn't lie flat, the surface is distorted. Replace the part or, if practical, have it machined.

Incidentally, if you ever need a cylinder head(s) or block of a V-type engine machined, the intake manifold may also have to be machined. The heads will be positioned inward and downward in relation to where they were before machining, causing misalignment between the heads and manifold.

- Be sure to get the right gasket. The wrong one won't fit. Be aware, too, that many gaskets have a right and wrong side, and they have to be installed right-side up. Gaskets are often marked with some designation, such as "this side up" to guide you.

- You may have a choice of gasket materials. For instance, oil-pan gaskets are made of cork, a combination of vegetable fiber and cork, or a synthetic-rubber compound. Cork is highly compressible, but must be handled carefully because it is easily torn.

A gasket that is made of vegetable fiber and cork is also highly com-

pressible, can withstand rougher handling than cork and is less subject to shrinking. Gaskets made of synthetic-rubber compounds, the latest innovation, are tough, they won't shrink, they are compressible and they are not affected by oils and greases.

- Be careful how you tighten an assembly following the installation of a new gasket. First, install all bolts finger-tight. Then, following the bolt-tightening sequence recommended by the car manufacturer (if there is one), use a torque wrench to tighten to manufacturer specification. (Consult the service manual.) Do not apply full pressure at once. Instead, first tighten each bolt part way. Then, repeat the process until recommended torque value is reached to assure even compression of the gasket.

- After completing installation, run the engine for a few minutes. Check around the sealing surface for leaks. If there is a leak, snug up bolts. If this fails, disassemble and check for dirt, an irregular surface or gasket damage.

- In the case of head gaskets, the head(s) should be retightened after the car is driven 300 to 500 miles. Heat expansion and contraction sometimes alter torque.

Oil-filter gasket

After cleaning the oil-filter seat on the engine, apply a light coating of engine oil to the gasket of the new filter and to the seating surface on the engine. Start the filter on to its seat, being careful not to cross or strip threads.

Hand-tighten the filter until the gasket touches the seating surface. Now, hand-tighten another one-half to three-quarter turn. This is sufficient to compress the gasket and form a secure seat. Do not tighten an oil filter with a wrench. After filling the crankcase with oil, start the engine and check for leaks around the filter.

Thermostat gasket

Before cleaning the old gasket and sealer from the thermostat gasket seat, stuff a clean rag into the hole in which the thermostat goes. This is done to prevent debris from falling in the engine.

Install the thermostat and coat both sides of the new gasket with gasket sealer. Put the gasket in place, carefully lay the thermostat housing into position and tighten the bolts finger-tight. Using a wrench, secure the bolts. Start the

engine and check around the housing for a coolant leak.

Fuel-pump gasket

After cleaning the fuel-pump mounting pad at the engine block or timing-gear cover, apply an oil-resistant sealer to both sides of the new gasket. Place the gasket on the fuel-pump flange and carefully position the pump against the mounting pad.

Holding the pump tightly to the pad, install mounting bolts. Tighten bolts alternately until they are torqued to specification.

Oil-pan gasket

If an oil pan has been sealed with a cork gasket, the gasket may, in time, deteriorate and allow oil to leak. After draining oil, remove the pan and clean the pan flange and engine.

Apply a drop of silicone-rubber, adhesive gasket sealer to each corner of the gasket. The sealer holds the gasket in place during the installation. Place the gasket on the oil-pan flange.

Put the pan back in position, hand-tighten bolts, and then tighten them to specification. You could easily distort the oil pan if the tightening procedure is not done carefully. Torque bolts in steps evenly around the pan to avoid warping the pan.

Some late-model cars use a chemical rather than a material gasket. These are silicones, called RTV sealants, applied to the oil-pan flange. The pan is bolted in place while the chemical gasket is wet.

In using an RTV sealant, apply a 3/16-inch-wide bead evenly around the oil-pan flange, inboard of the bolt holes. Don't allow the liquid to block the holes, and don't leave a gap in the flow, since the seal will not be complete.

Rocker arm (valve) cover

After cleaning the surfaces, apply a thin coat of gasket adhesive to the valve-cover flange. The purpose of the adhesive is to keep the gasket in place—not to help seal the area. Do not apply adhesive to the gasket.

Lay the gasket on the valve-cover flange and allow adhesive to dry. You can tell when it is dry by applying light finger pressure to the gasket. If the gasket slides away from the flange, the adhesive is not dry. Premature installation of the valve cover on the engine will destroy the fit and cause leakage.

Tighten the cover to manufacturer specification. Do not overtighten. You will distort the cover. **FM**

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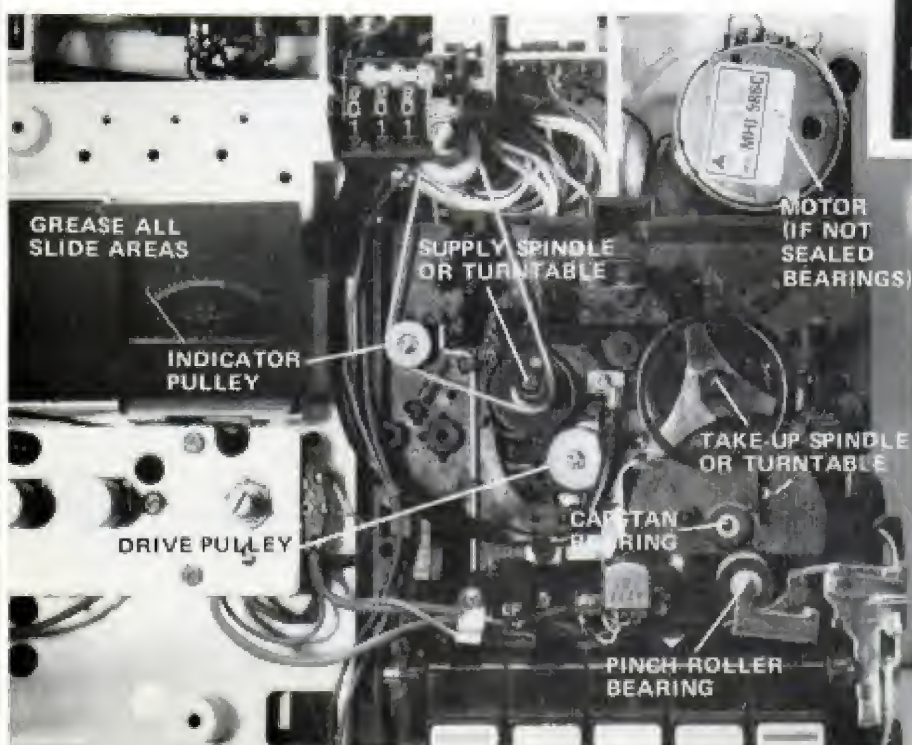
Keep your cassette recorder sounding new

It's not hard to repair—and maintain—your cassette tape recorders. A few simple tools, a bit of knowledge and ambition can save the costs of professional repair!

by Homer L. Davidson



Keeping all your cassettes playing like new means good maintenance and savvy repair. We show you some "professional" tricks of the repair trade.



Better to use too little oil than too much when you lubricate the drive pulley, capstan, spindle, pinch roller and your cassette recorder's motor bearings.

In most tape players, cleanup and lubrication solve many repair problems. If your cassette player is located in a portable unit or in a large compact tape deck, you can prevent future repair problems by using simple maintenance routines.

Just a good cleanup

When the cassette player is used extensively, the tape head, pressure roller and tape guides should be cleaned every month. If played only periodically, be sure and clean them at least once a year. You may be surprised to see how much reddish tape-oxide dust collects in a very short time.

To prevent tape-oxide buildup clean off the tape, contacting surfaces, record/play (R/P) head, erase head, capstan and pinch roller with a piece of soft cloth soaked in wood alcohol. You can use a cotton swab to apply the alcohol to the various surfaces.

When tape oxide is packed on the tape head and alcohol cleaning doesn't remove it, use a pencil eraser or wooden dowel to clean it off. *Do not use a screwdriver or knife blade*



Use a cotton swab to apply cleansing alcohol to tape head, guides and roller.

or you may scratch the head surface. After removing the packed oxide, clean with alcohol and cloth.

To prevent tape-oxide buildup you may want to use a cassette tape cleaner. Place the cleaning cassette into the player and turn the unit to play position. Only a few seconds are needed to keep that excess oxide off the working components.

Some areas to lubricate

Although most cassette tape players seldom require lubrication, slow or erratic speed may be caused by a dry bearing. When a squeaky or rattling noise is heard with the player operating, lubrication might be needed. However, *very little is better*

(Please turn to page 37)

HERE COMES SKIL'STM BOAR GUN!

This exclusive new fast-chargin' cordless drill and screwdriver comes loaded with power and features to blast through big jobs.



Powered for the professional! Made tough, for the pro who uses a drill more than any other tool. Made powerful, to work long, hard hours every day—and recharge in just one hour. Made with features like variable speed and reverse, for driving and removing screws and tough drilling jobs.

Skil's Boar Gun Model 2016 drill/screwdriver has Dual-Torque: two powerful gear ranges that maximize power at the chuck.

"High" delivers 0 to 750 rpm for high speed drilling;

"Low" provides 0 to 250 rpm at high torque, for tough drilling and driving applications.

Boar Gun drill/screwdriver recharges in just one hour, thanks to Skil's remarkably efficient Power Paks. With a pair, you'll be able to rotate 'em and drill all day—with no delay. Plus, each Power Pak can be recharged up to 1,000 times before you replace their long-life batteries!

See Skil's 3/8th-inch Boar Gun Model 2016 drill/screwdriver with Dual-Torque (mfgs. sugg. retail: \$99.95), and models 2008 and 2012, with single torque ranges (mfgs. sugg. retail: \$89.95), at your participating Skil dealer. All models include one Power Pak and charging unit. Now you can do it with Skil—and save. With the tool it took Skil to build: Boar Gun Cordless drill and screwdriver!

Do it with *SKIL*.

SPECIAL INTRODUCTORY POWER-PAK OFFER:

For a limited time, you'll get a second Power Pak (\$29.99 manufacturers suggested retail

price) for just \$5.00, plus a full year's free service. Offer expires Dec. 31, 1979.



Power to drill hundreds of holes in hardwood. Variable speed and reverse.



Drills in metal. Variable speed for tough screwdriving.



Even drills in tough masonry.

Portable refrigeration price breakthrough! Now only \$134*.

Solid State Refrigeration makes portable coolers as obsolete as grandma's kitchen ice box.

The kindest thing you can say about ice boxes is they're better than nothing.

They fall down on the job in hot weather. They look more like swimming pools than refrigerators when the ice melts. And, every other day, you have to dig into your pocket to buy more ice. (If you can find it).

Koolatron's 12 volt portable refrigerators work on thermoelectrics, not ice. And maintain normal refrigeration temperatures.

So taking the Koolatron on your trip is like taking a small version of your home refrigerator. Everything - and everybody - stays cool.

USES AEROSPACE REFRIGERATION MODULES

The Koolatron portable cools your food electronically with solid state thermoelectric refrigeration modules. These same powerful modules are used by military and aerospace scientists to cool critical components in rockets and satellites. They use thermoelectric cooling because of its absolute reliability, insensitivity to motion or level, small size & weight and minimal battery drain.

WHY IS THE KOOLATRON PORTABLE SO MUCH BETTER THAN AN ICE CHEST?

An ice chest maintains an air temperature of 50-60 deg. F. Meat and milk spoil rapidly at temperatures above 50 deg. F. which is why the top of your meat will go bad even when it is sitting on ice. Koolatron portables maintain normal home refrigeration temperatures of 40-45 deg. F. even in 95 deg. F. weather.



Two of these miniaturized thermoelectric modules replace all the bulky complex piping coils, compressors and motors in conventional portable refrigerators. The modules pump heat from your food into efficient heat sinks where it is dissipated by a quiet fan. They operate on a principle called the "Peltier Effect" - passing electricity through the junction of dissimilar metals causes heat to flow away from the junction.

BOATING, FISHING, CAMPING, HUNTING

Fits into virtually any boat, van or camper. Carry it on the back seat during car trips. Ideal for fishing and hunting - bring your catch back home fresh (a few loads of fish fillets could pay for your portable). Use it for grocery shopping, medicines, carrying film, salesmen's samples. Take it to the drive-in movies, auto races and other sporting events. With an inexpensive battery charger

you can use your Koolatron as a bar fridge all winter and a patio fridge in the summer. Run it in your motel room at night and enjoy a midnight snack whenever you feel like it. We have customers using our portables on construction sites, in workboats, laboratories and even in locker rooms for a "cold one" after the game.

THE ULTIMATE PORTABLE REFRIGERATOR

It weighs less than most coolers with a block of ice but holds over 40 lbs. of food or 48 pop cans in its large 36 qt. capacity. Plug it in a lighter socket in your car, boat or van or operate it from a 12 volt battery charger plugged into 110 volts. Cold contents will stay cold overnight with unit off. Draws a maximum of 4 amps., averages about 2 amps. at 70 deg. F. with the thermostat on. Keeps your food cold and dry. Exterior dimensions are 21" L x 16" W x 16" H. Interior dimensions are 16" L x 11-1/2" W x 12" H.

BUILT-IN QUALITY AND DURABILITY

The rugged "ABS" case is filled with the best insulation available - rigid urethane foam. It has a "150 lb. test" handle and non-rusting polypropylene hinge and latches, with stainless steel fasteners. The exterior is harvest gold with a white interior and has 4 non-slip rubber feet. Your portable comes with a 9 ft. detachable cord which plugs into your cigarette lighter. It also has terminals for attaching wires directly from a battery or fuse panel. The same terminals are used for your battery charger clips when operating from a charger. A reverse polarity warning light & buzzer are included. Because of Koolatron's solid state construction your unit should never require any servicing unless physically damaged. If service is ever required, it is available through our service depots in Batavia, NY, or Barrie, Ont., Canada.

GUARANTEE. 21-DAY MONEY-BACK TRIAL PERIOD

Your Koolatron comes with a written 1 year guarantee plus complete instructions and helpful information about batteries and chargers. If for any reason you are not totally satisfied, return it for a prompt refund in full.



PAYS FOR ITSELF

If you are regularly using ice, your Koolatron portable will pay for itself with the money you save on ice, spoiled food,

restaurant bills and the gasoline used looking for ice.

SPECIAL OFF SEASON DISCOUNT!

The Koolatron F1 has regularly been selling at \$159. (\$179 in Canada.) By ordering off-season you can save a full \$25 off these prices. You save! We keep our plant at an efficient operating level off-season! But you must order now.

ADJUSTABLE THERMOSTAT OPTION

For an additional \$10.00 you can order the Koolatron portable with an adjustable thermostat in place of the standard fixed temperature thermostat - order Model F1A.

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This custom-made adaptor lets you operate anywhere on 110 volt power... home, cottage, motel, patio, pool... only \$29.95. (\$34.95 in Canada.)

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Koolatron INDUSTRIES LIMITED

56 Harvester Ave., Batavia, New York 14020
Canada: 230 Bayview Drive, Barrie, Ontario L4N 4Y8 Dept 902

Send me ___ Koolatron F1 @ \$134.00 (\$154.00 in Canada) + \$7.00 each for handling and delivery in USA or Canada (N.Y., Ont. and Que. residents add sales tax.)

___ I want model F1A and have added \$10.00.

___ I also want the power adapter and have added \$29.95. (\$34.95 in Canada.)

I understand that I may return it undamaged within 21 days and get a full refund if I am not satisfied. I enclose my ☐ check ☐ money order for \$____ or, please charge my ☐ Visa ☐ Mastercharge ☐ American Express.

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Expiry Date _____ ☐ Send brochure only

Signature _____ (necessary to ship merchandise)

Name _____

Address _____

City _____

State _____ Zip _____



*
**DURING
OUR OFF
SEASON.**

The Koolatron portable keeps over 40 lbs. of food at household refrigeration temperature but weighs only 15 lbs. Only 21" x 16" x 16" ext. Model F1A shown

CASSETTE RECORDER

(Continued from page 34)

than too much lubrication of the tape mechanism.

A drop of oil, such as 3-In-One or light oil may be applied to the drive pulley, capstan, spindle, pinch roller and motor bearing. Today, most motor bearings are sealed, so don't bother with it. Just apply a drop of oil on the end of a pencil point or the wooden end of a cleaning stick and then place it upon the bearing area. Do not lubricate drive surfaces. Wipe off any excess with alcohol and cloth. Make sure all drive surface areas are clear of oil and tape oxide.

Using a test tape

A cassette test tape may be used to make azimuth and frequency adjustments of the cassette tape player. You may also use it as a sound source in troubleshooting the amplifier section.

The only tape head adjustment is for azimuth, or level, adjustment of the tape head. Generally, tape head azimuth adjustment is required only after replacement or disassembly of the R/P head. The azimuth adjustment screw is one side of the tape head mounting screw. You can spot it very easily, since a small spring is wrapped around it. Don't adjust any other screws around the tape or erase head. You may find, in some smaller units, all heads are in a fixed position.

To properly make azimuth adjustments insert the test tape and connect a VTVM to the earphone jack. Use an 8-ohm dummy load resistor across the VTVM leads. Switch the player to play mode and adjust the azimuth screw for maximum reading on the VTVM. The frequency response of the cassette player may be checked by following the directions found with the test cassette.

Checking the tape head

The tape head may be checked with a known cassette recording or an ohmmeter. But, before checking the tape head, clean off the excess oxide.

Pass the blade of a screwdriver or pocket knife in front of the tape head with the volume wide open. If okay, you should hear a flutter sound in the speaker. If a loud sound is heard, the cassette may not be seating against the tape head. When all cassettes will play except one, suspect a defective cassette!

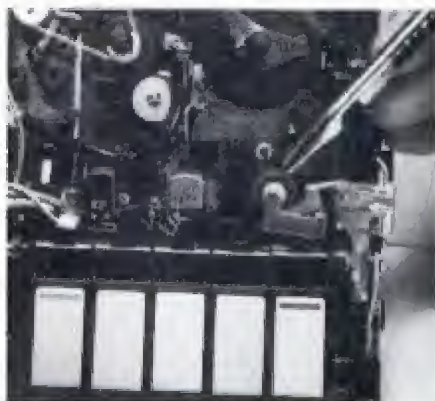
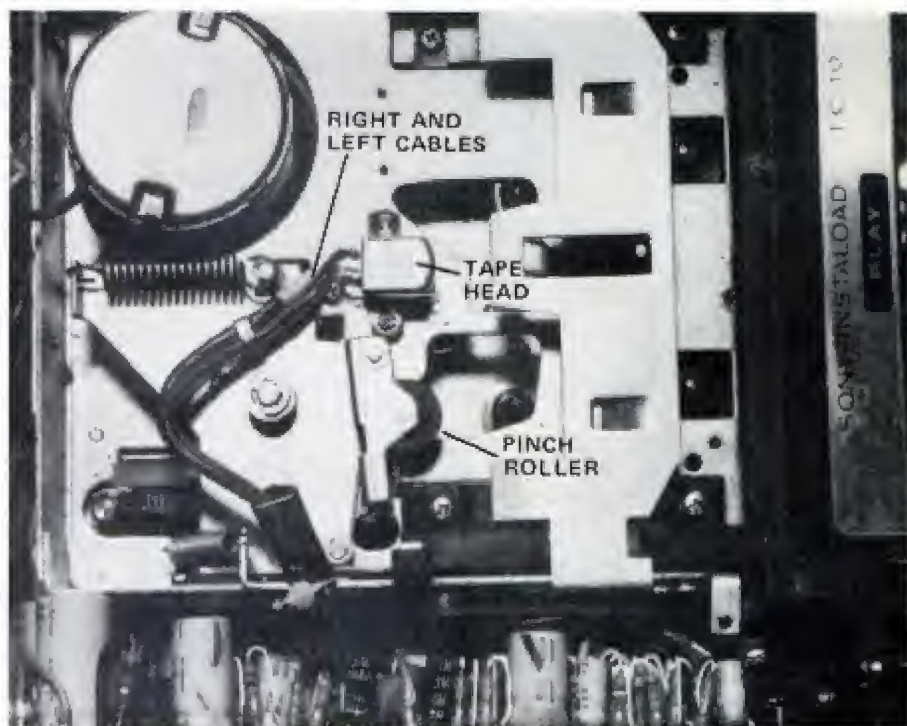
If no sound is heard, place the screwdriver blade upon the ungrounded lead of the tape head. Generally, you will notice a loud hum,

(Please turn to page 38)

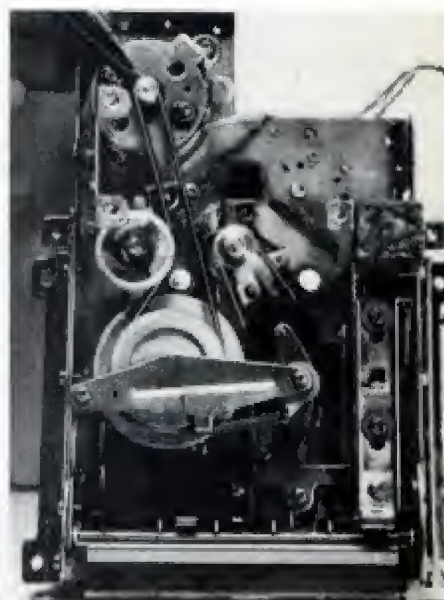


Use a test tape to make azimuth and frequency adjustments of the player. You'll also need a VTVM to make the critical adjustments.

You can check a tape head by passing a screwdriver blade in front of it and turning up volume. Text tells how to check the cables.



A defective or dry pinch roller can cause slow or erratic speeds.

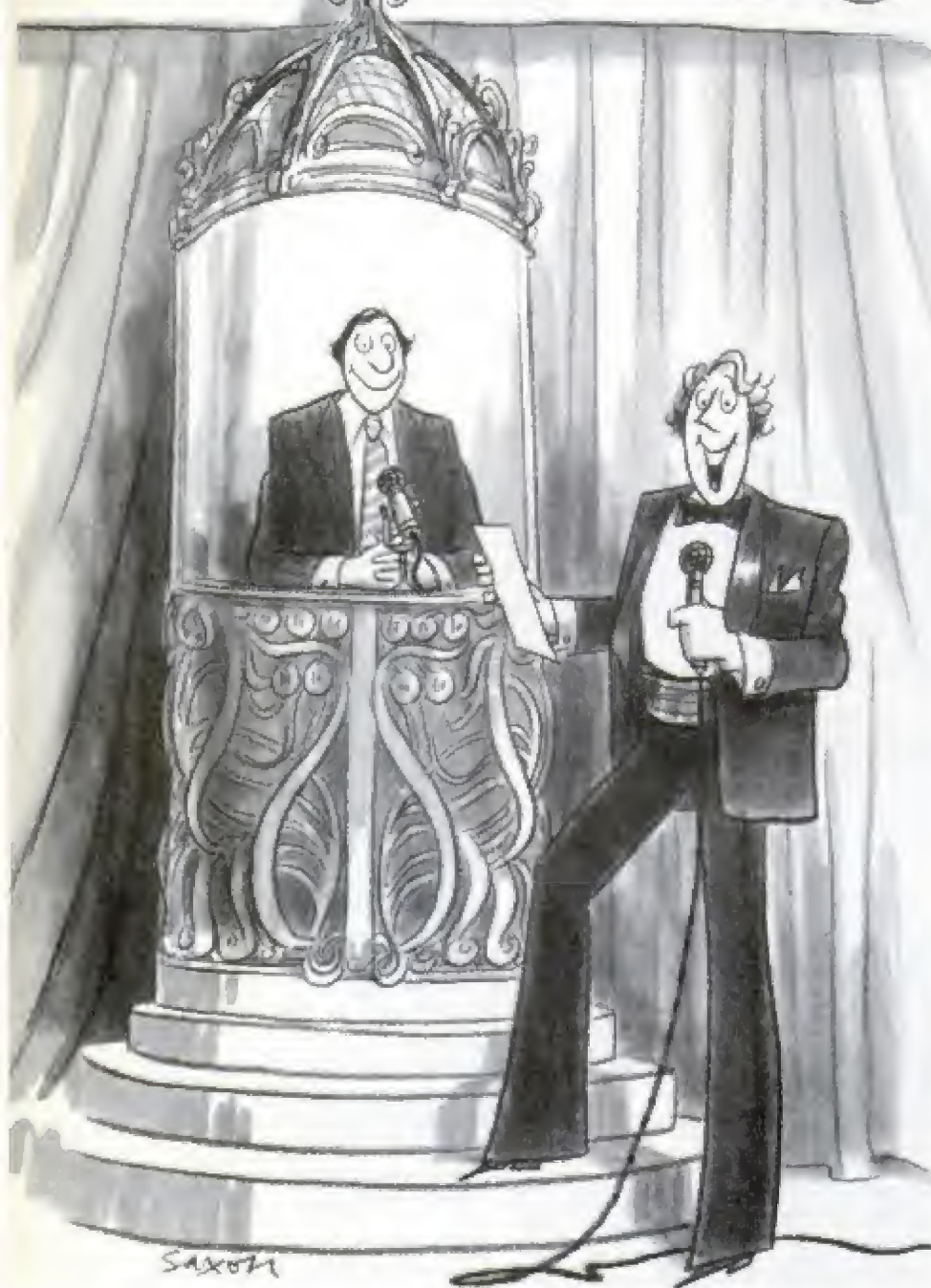


Speed problems may also be caused by a stretched or broken motor-drive belt. If you replace belt, first diagram how to put it back!



One of the small, plastic switches will sometimes break off at the mounting terminals. It can usually be repaired simply by epoxying it together.

IR QUES



*"You can stop now with the luxury yacht,
the his and her Lear Jets...
or risk it all and go for the Chivas Regal."*

CASSETTE RECORDER

(Continued from page 37)

but no sound may mean a broken cable wire at the tape head. A monaural cassette player will have only one R/P tape head, with two connections in the tape head. The stereo cassette player will have four lead connections going to the tape head. The shielded lead of the tape head connects to ground or a grounded circuitry. You should hear a loud hum when the screwdriver blade touches the amplifier lead.

Okay, now we have a loud hum noise indicating the amplifier is good, but the tape head is defective. Let's do another test, using the ohmmeter.

Unsolder the connecting lead from the tape head and connect the ohmmeter across the tape-head terminals. A normal resistance reading may be found from 100 to 800 ohms. Check both head terminals in a stereo tape head. When no reading is indicated, replace the tape head.

The defective tape head may have a continuity reading and still produce poor frequency response. When this occurs you may have a weak or tinny sound. It sounds as if the speaker is mounted inside a tin can. Check the tape head for excessive wear marks on the tape area's front surface. Replacement of the tape head is the only answer to poor frequency response.

Slow and erratic speeds

Perhaps the greatest problem found in cassette players is speed conditions. The speed is too slow or erratic in play, rewind and fast forward modes. Most speed problems are caused by oil on the drive surfaces, dry bearings and/or motor belts. Maybe a good cleanup with alcohol and cloth is all that's needed.

A defective or dry pinch roller may produce improper speeds. Remember, the pinch roller and capstan should pull the tape across the tape head at a constant speed. First, clean off the excess oxide from the rubber roller. If defective, replace it. You may find the pressure of the pinch roller can be increased by a small tension spring with one end in a hole on the chassis. To increase the tension, move the spring end up a notch to another hole. Generally, a good cleanup and a drop of oil on the pinch roller gets it working again.

Check the motor drive belt and clean off the belt with alcohol and cleaning stick. If the belt stretches, the speed may slow down. Before removing the belt, check in what direction the tape goes around the vari-

(Please turn to page 40)

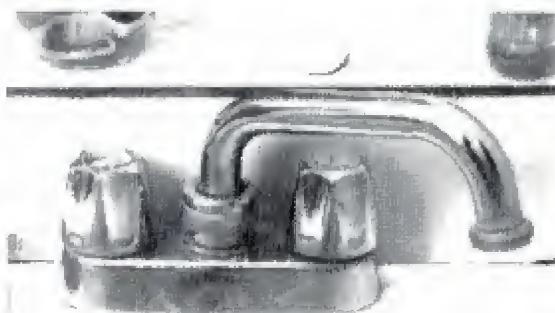
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- ☐ Vulcan Reseating Kit for 20 installations — includes basic 8 seat kit as above PLUS 12 extra stainless seats, 12 extra Delrin® washers — \$14.90 plus \$1.00 postage & handling — \$15.90 total.
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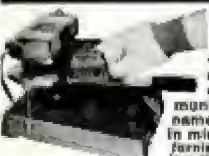
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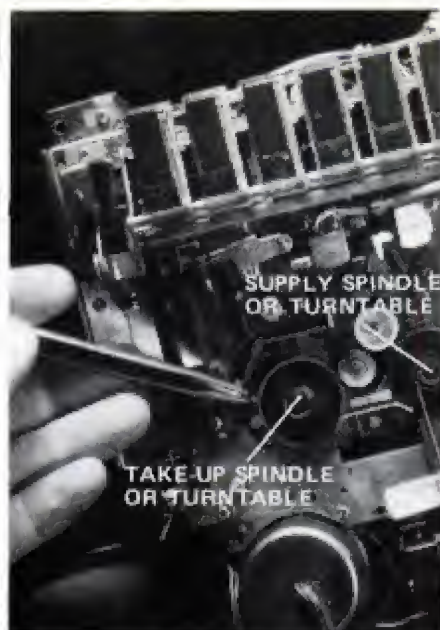
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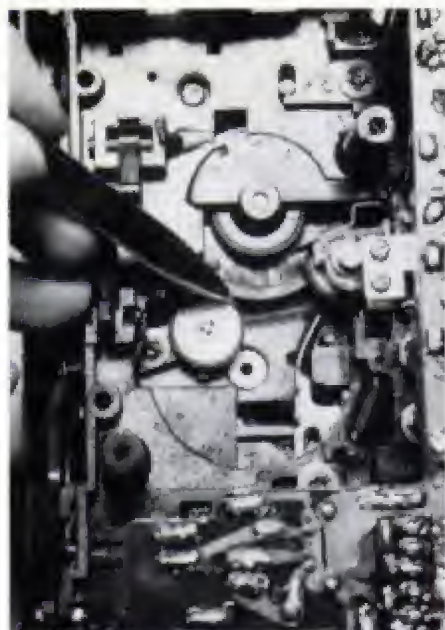


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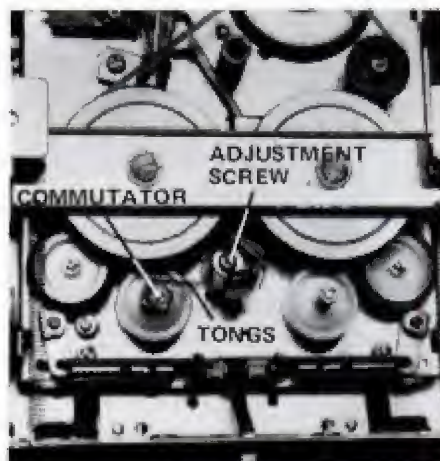
CASSETTE RECORDER (Continued from page 38)



If oil gets onto a spindle it can result in no operation or in erratic speed.



Check that the drive pulley is engaging flywheel if takeup reel is slow.



Clean commutator switch if there's problem with auto-reversing unit.



Tape demagnetizing tools come in all shapes. Get one that reaches tape head!

ous pulleys. You may want to draw a small diagram showing the correct location before removal.

No sound—no rotation

So you turn the cassette player to play position and nothing happens. Rotate the volume control wide open and listen for a rushing sound. If there's no rushing noise, the amplifier section is dead. Try the player in fast-forward or rewind position. Bend your ear down to the player and listen for a rotating motor sound. If you still hear nothing, suspect a broken cassette on/off switch. Sometimes, the small on/off switch may be broken off at the plastic mounting terminals. Replace the switch assembly if one of the leaf terminals is broken off. If, by chance, the motor runs all the time, check for a bent leaf switch.

When you can hear the motor and no tape rotation, the cause may be a broken or loose motor drive belt. In

fact, you may find the belt off the motor pulley. These belts are very thin and may slip at the motor pulley, as shown in the photo. Remove the small belt from the motor and give the motor pulley a spin. Replace the motor if it starts to rotate or appears dead when 12-volt d.c. is found at the motor terminals.

Cassette won't hold capstan

In most large cassette tape decks, the cassette is loaded into the holder and, when pushed to play position, the pressure roller is applied to the tape and capstan drive area. You may find a broken switch or foreign material. Clean off with alcohol and lubricate the cam areas with a light grease. Check the loading springs for correct tension. If springs appear to be loose, cut off one or two rounds of tension spring, reconnect.

When facing any cassette player, the cassette spindle to the right is

(Please turn to page 208)

How to select a sound system for your car, boat or plane.

Audiovox candidly reveals what you should look for, listen to and beware of.

By Robert Harris, Technical Director

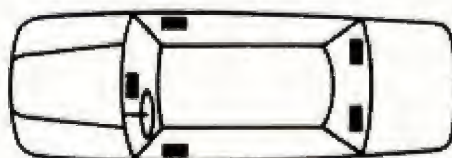
You are confronted by everything from \$50 AM radios to \$1,000 high fidelity systems. Where should you shop? How much do you really need to spend? Read on as Audiovox throws some light on the subject.

Audiovox aims to provide American motorists with a level of sound reproduction previously attained only in the home — through a range of more than 139 systems and components.

Where to buy.

Manufacturers with a limited range of products need to sell *all* of their products to *all* types of stores.

Audiovox, on the other hand, markets 3 totally *different* product groups. The regular group — providing superior sound reproduction at a reasonable price and available through conventional retailers, chain stores, and catalogs; the S.P.S. (Special Performance Series) featuring original equipment styling and features — available only from new car dealers; and the Hi-Comp group — a complete line of "state of the art" components, available through car stereo specialists.



How much good sound should cost these days.

You can pick up a basic AM radio for about \$50. The average cassette or cartridge player with built-in AM/FM radio and two good speakers will cost about \$150. And if you want to shoot the works, Audiovox builds an electronically-tuned receiver/cassette player with auto-reverse, the HC65 speaker system, a 60-watts-per-channel amplifier, plus Dolby®, CrO₂ switch, parametric equalizer, etc. for around \$950. (Installation charges excluded.)

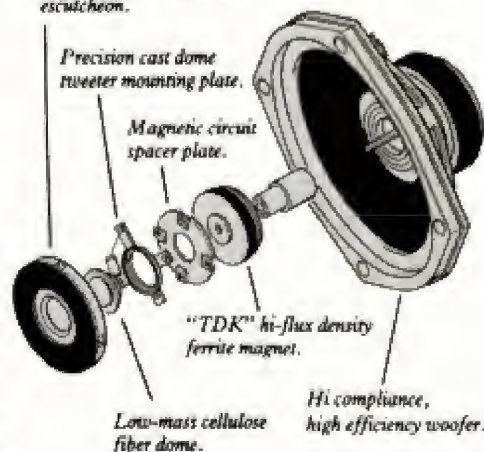
Speakers — Facts you should know.

As with home hi-fi, speakers are the most important component of a mobile sound system.

The key issue is *compatibility*. With power out-puts of 60 watts per channel

and up, an inappropriate set of speakers will blow out. If you play your Audiovox receiver/amplifier through power-matched Audiovox speakers, the performance of the system will be optimized to the fullest.

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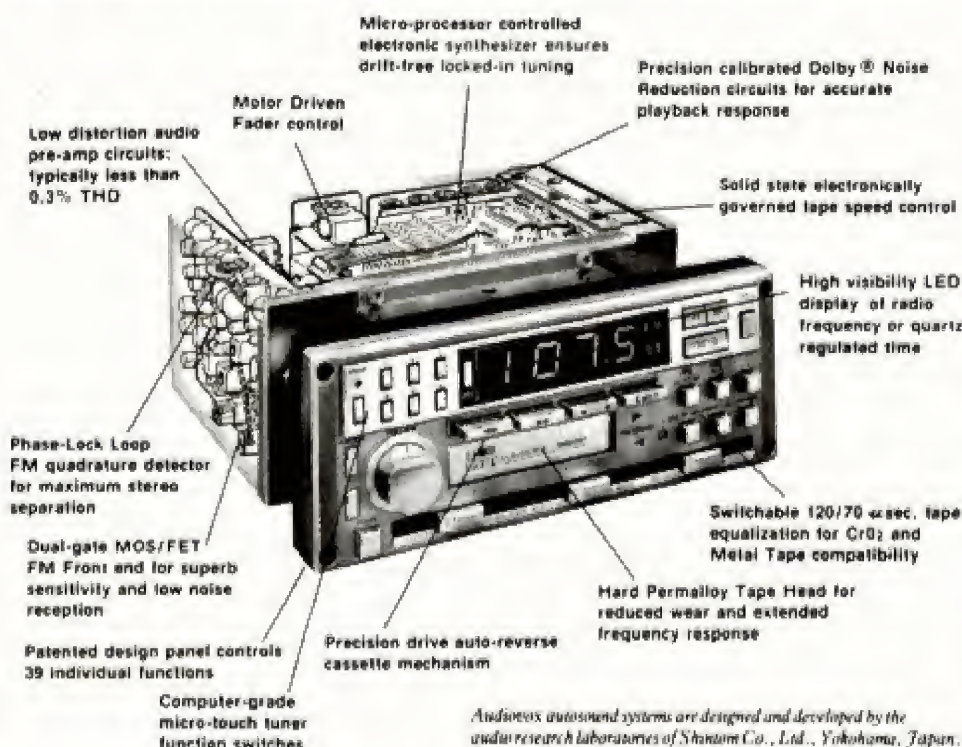
Audiovox sound systems have a remarkable pedigree. The single-minded pursuit of superior sound in automobiles has never been diluted by diversification. The state of the Audiovox art is superior mobile sound systems.

For further information, write to R. Harris, Dept. PM, Audiovox, 150 Marcus Blvd., Hauppauge, New York 11787.



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PM's Whatsit

We can tell you that this device, patented in 1872, is but a scale model, which was required of all inventors applying to the U.S. Patent Office between 1790 and 1880. We can also tell you it looks just like what you would expect it to look like. Considering the year and the configuration, what's your guess? (Turn to the next page for the answer.)

Transfusing yourself

A study of more than 100 pre-operative patients who made "deposits" at their local blood bank against the possibility of emergency withdrawal during surgery was recently reported to the American Medical Assn. The researcher, Dr. Arthur Silvergleid, says this technique is "unquestionably the safest blood transfusion method available."

The individuals prepared for surgery by donating up to three pints of blood over several months in advance. Kept in cold storage, it was supplied to those who needed it during or following their respective operations. The surgical procedures varied—ranging from hysterectomy to knee replacement—but had in common the fact that they could be scheduled well in advance.

The follow-up showed no transfusion reactions—which is a slight risk whenever someone else's blood is infused; there was also no transfer of serum hepatitis, an even greater, ever-present transfusion risk.



PM follow-up: HiMAT's first flight

Although the official NASA photo arrived too late to have a place in our feature story on remotely piloted vehicles (page 93), we thought PM readers deserved a look at the Highly Maneuverable Aircraft Technology tested in flight for the first time. Dropped from a B-52 at 45,000 feet over NASA's Dryden Research Center in the California desert, the HiMAT was flown from the ground for some 20 minutes of high-G maneuvering, landed successfully on its skids on the dry lake bed.

Wait for the green

The Federal Aviation Agency has begun tests on a seemingly uncomplicated traffic control system which may become standard equipment at all major airports. It's basically a cluster of pulsating (when turned on) green lights mounted at takeoff positions on the left side of a runway. The system is called VICON, short for Visual Confirmation of Voice Take-off Clearance. When a tower controller clears a plane

for takeoff, he simultaneously pushes a button which turns on the green cluster. The pilot would require both visual and aural clearances before rolling. The plane's interruption of an electronic beam as it passes a given runway position can be used to turn the lights off—as can a simple 30-second timer.

Doesn't sound like big news, but the fact is that this system is a direct result of aviation's worst disaster, which occurred on March 22, 1977, at Tenerife in the Canary Islands, when two 747 jetliners collided, killing more than 570 persons. The probable cause of that accident has been attributed to one pilot's misunderstanding of a verbal takeoff clearance.

Whatsit revealed



The row of protruding barrels can only suggest a multiple-firing weapon, and this was an early attempt at a machine gun. Furthermore, its inventor claimed *each barrel* could "throw 60 balls a minute...to cut down double files of soldiers or destroy a cavalry charge." The working model, we assume, didn't quite live up to its billing. Many other fascinating Patent Office models are on display at the Hagley Museum, site of the original Du Pont Co. black powder works at Greenville, Del., just north of Wilmington. As opposed to the Smithsonian Institution's collection of major American inventions, the Hagley's are offbeat, but quite entertaining.

PARKING
FOR
O'Brien's
ONLY

ALL OTHER CARS WILL BE
CRUSHED & MELTED



Well, I'm from Missouri...

Any downtown or shopping mall establishment that goes to the trouble of putting in the usually bountiful (as required by most zoning codes) parking lot for its patrons usually faces the same problem: Nonpatrons with cars who want to "borrow" a space while they just dash in to get their poodles clipped. The old "towed-away-at-your-expense" line has become a hollow threat. So one restaurant in the St. Louis suburb of Richmond Heights, Mo., decided to escalate parking-lot rhetoric.

So far, even after six months, the sign seems to be working pretty well.

(UPI photo)

Rigid airships—still a tempting concept

A British firm recently completed a dirigible—rigid airship—for use as a utility vehicle in South America, punctuating the fact that dirigibles are still very much with us. The Hindenburg tragedy at Lakehurst, N.J., in 1937 spelled the end of commercial lighter-than-air travel, so far as most Americans were concerned, but it also obscured a remarkable record of flight achievements coupled with—up to then—safe operations. Fifty years ago, the Graf Zeppelin LZ 127, pictured here at Berlin's Tempelhof Airport, circled the globe. Completed two years before, in 1927, the hydrogen-filled craft took 20 days and 4 hours to pass over Siberia, Japan, the Pacific, the United States and the Atlantic before returning to its place of departure at Friedrichshafen on Lake Constance in Southern Germany.





The new Energaire ionized oxygen generator will make a handsome addition to any desk.

Miracle Fuzz

A new space-age invention and the same effect as lightning combine to create the world's first home oxygen regeneration system.

You need oxygen to live. You can live without food for 60 days, without water for seven days, but without oxygen, you won't make it past two minutes.

That small piece of fuzz located on top of the cylinder shown above emits negatively-charged electrons which attach themselves to molecules of oxygen, thus creating ionized oxygen.

You are already familiar with ionized oxygen if you've smelled the air after a thunderstorm. You feel great, revitalized, and alert. The lightning from the storm adds a small negatively-charged electron to each oxygen molecule in a process called ionization.

SCIENTISTS DISCOVER

Scientists discovered that air quality can actually affect your moods, your feelings and your sense of well being. Air that is positively charged caused people to be depressed, moody and tired. Negatively-charged air made people feel good. We have all experienced air that is positively charged in air-conditioned buildings or in a polluted environment.

Scientists looking for a way to turn positively charged air into negatively charged air developed the negative ion generator—a product that produces negatively charged particles that attach themselves to air molecules and thus create the same fresh feeling you get after a thunderstorm.

The new space-age product shown above is an ionized oxygen generator called the Energaire air purifier. The copper mesh fuzz on top of the unit is one of the secrets of the system.

Although it has no moving parts, you can actually feel a wind of ionized oxygen produced from the fuzz which spreads to fill an average-sized room in one minute.

CIGARETTE SMOKE TEST

To show the dramatic effect of ionized oxygen, you can take the Energaire, blow cigarette smoke into a clear bowl, and hold the bowl inverted over the system. The smoke will vanish. The charged oxygen particles appear to dissolve the smoke particles, precipitating them from the air.

In a room, the Energaire air purifier surrounds you with these oxygen ions and cleans and purifies the air so that even in a smoke-filled room, you will be breathing cleaner, country-fresh air all day long.

WALL TEST

Take our unit and place it next to a wall. Also

put a large piece of paper on the wall. Within a few days notice how black the paper gets. That black film is finite carbon particulate matter—the same pollutants you would normally breathe and that would pass through most air filters. By placing the unit in the center of a room or away from a wall, that same matter falls to the ground as dust.

A trip into the mountains exposes you to nature's freshly ionized oxygen. The Energaire produces this same effect. It will clean your room of odor-causing bacteria and stale, musty, or smoky air.

Ionized oxygen should not be confused with ozone. Ozone has a molecular formula of O_3 , whereas the molecular formula for ionized oxygen is O_2 with a negatively-charged ion.

DON'T BE CONFUSED

After we announced the Energaire last year, many companies came out with their own ion generators. We purchased a unit from each company and tested them at an independent laboratory. The results are shown below:

Name	*Ions	Price
Energaire	438,000	\$79.95
Omega 700	63,000	245.00
AirCare	72,000	149.95
Modulion	75,000	79.95
EnvironAire	-0-	119.50

The one unit mentioned above that produced no ions actually produced ozone—15 times the maximum ozone concentration allowed by federal government standards.

**Measurements indicate total number of ions per cubic centimeter per second at one meter. These figures may vary by plus or minus 10%.*

USED IN HOSPITALS

Many hospitals are now using ionized oxygen systems in their operating rooms and burn centers. Their units not only purify the air, but they also eliminate pollen and other irritants.

Working in a clean air environment, you think clearer, are more alert, and you function better. The Energaire is actually a miniature lightning machine. The minute you plug it in, energy is converted into ionized oxygen. This efficient system uses one watt of power or less than a penny per day to operate, so you leave it plugged in continuously.

We are so impressed with the pleasant effect of Energaire that we urge you to personally test it yourself in your home or office. Order one at no obligation. Put it by your desk, or in any room where you spend a great deal of time. See if it doesn't rid your room of odor-causing bacteria and stale, musty or smoky air. Try the smoke and paper tests mentioned in this advertisement.

SLEEP FASTER

At home, use the Energaire by your bed and see how country-fresh air allows you to sleep easier, deeper, and more relaxed.

You should notice the difference within one day—especially in a work environment. But use the Energaire for a full month. Then, if you do not feel totally convinced of the positive effects of ionized oxygen, return your unit for a prompt and courteous refund.

The Energaire is manufactured by the Ion Foundation, a leading ion research and development company.

Service should never be required, but if it is, there's a prompt service-by-mail center as close as your mailbox. JS&A is America's largest single source of space-age products—further assurance that your modest investment is well protected. The Energaire measures 9" high by 3" in diameter and weighs 24 ounces.

To order your Energaire ionized oxygen generator, send \$79.95 plus \$3.00 for postage and handling (Illinois residents, please add 5% sales tax) to the address shown below or credit card buyers may call our toll-free number below. We will send your Energaire ion generator complete with 90-day limited warranty on the electronics, a five-year warranty on the fuzz, and complete instructions.

Let space-age technology revitalize your life with the world's first home ionized oxygen generator. Order one at no obligation today.

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ALL OUTDOORS

Merc muscle machine

The world's largest outboard motor has arrived. It's a six-cylinder black package that corrals the power of a herd of 300 horses.

As we predicted last month, the outboard companies have been holding back on general release of some of the potent powerplants they developed and perfected for racing, waiting for the right time and market. This fall Mercury Marine announced a jump from 200 hp up to 225 for 1980 motors. Now the company has dropped the other shoe and suddenly unwrapped its V-300. That's 65 hp more than the previous line leaders—the Evinrude and Johnson 235s.

Do we need bigger outboards right now? The boatmen who buy them will provide the answer, but Mercury's betting that owners of heavy, big-water, offshore hulls will find two-cycle power and convenience worth the \$5500 price tag. For the limited hours a pleasure-craft skipper runs his boat, it's assumed he is more interested in performance than in the cost of gasoline.

Fuel economy is claimed in several ways for this new V-300, however. Merc estimates that an inboard engine with equivalent power would weigh about 1100 pounds. A stern-drive could top 1300. The new Mercury V-300 weighs in at 565, for a savings of 500 to 700 pounds. Just this weight differential, plus the outboard ability to tilt and trim a hull to the most economical planing angle, will improve handling and gas consumption, points out Ham Hamburger, Mercury V.P. and general manager. And as an added bonus, the lighter weight makes the rig easier to haul out and tow down the highway with a small compact car, for an additional fuel savings.

More speed is possible, of course, with the new engine, but the gas economy available at slower speeds with less than full throttle, plus the ability to push larger offshore hulls, are rated as primary advantages. Merc claims its loop-charging system can deliver 20 to 30 percent more miles per gallon over competitive engines with cross-flow charging.

The 208-cu.-in. engine has six single-barrel carburetors, one each for the cylinders in the two banks of three, set at a 60° angle. A new gear case, cast-aluminum power head and stainless-steel water pump for

corrosion resistance are additional features.

What Merc calls a Hydrasteer power-steering system is an interesting turn-assist that works by means of a pivoting fin on the anti-cavitation plate of the lower unit gear case. Instead of the adjustable tab locked in place to offset torque resistance in steering, this new fin arrangement acts like the servo trim tab on an aircraft control surface that moves in the opposite direction of the rudder or elevator. This Merc innovation for its big mill is linked to the steering push-pull



Most powerful outboard motor made is new V-300 for 1980 from Mercury Marine.

rod with cables that force the tab into the water flow. Water pressure then helps turn the engine and makes steering much easier.

The outboard motor business is very competitive, and Johnson, Evinrude or Chrysler may also announce production models of their racing engines shortly. In the past, helicopters, speedboats and perimeter spies have been used to keep track of engines under development.

Several years ago, after a race boat threw its cowl, flipped and sank during the Paris six-hour marathon on the Seine, engineers and crew chiefs from other racing teams showed up on the river bank early the next morning with binoculars and telephoto cameras to watch the salvage operation. As a crane slowly raised the boat from the water, a gray bulge on the transom showed where the motor was wrapped and tied inside a large tarpaulin. It had been too dark to haul out the boat the night before, so skin divers had been sent down in the black river to wrap and hide the details of the racing engine. This kind of rivalry seems to benefit all boatmen with better engines for the sport.

How to—where to

Outdoorsmen who fly are now covering longer distances in light planes, and the best book to come along for crossing open water is certainly Louise Sacchi's *Ocean Flying*, \$14.95 from McGraw-Hill. A careful and adventurous pilot can now take off in his own plane for Europe, Asia or Australia; this book tells how. With her own ferry service, plus over 330 personal ocean crossings to her credit, Sacchi's advice and her reasons for preferring single engine aircraft carry a lot of weight.

Noted boating author and PM contributor Bob Whittier has just written a down-to-earth-and-water guide to picking the right boat, new or used, big or small, outboard, inboard or stern-drive. The \$9.95 to Axtex Books, Box 50046, Tucson, Ariz. 85703, for *How to Buy a Boat* is a small price to help find a dreamboat, instead of a dog.

For touring ashore, especially by recreational vehicle, a new *Snowbird RV Travel Directory* by Stan Christian, \$8.45 from Snowbird, Box 1059, San Jacinto, Calif. 92383, lists free campgrounds and overnight rest stops, free dump sites, discount gas stations and factory outlet stores along the interstate highways in 48 states, plus good tips for ways the full-time RV traveler can cut costs.

Frostbite, wind chill, avalanches, cold-weather first aid, even which ski wax to use, are among the topics in the pocket-sized *Winter Recreation Safety Guide*, \$1.60 from Public Documents, Pueblo, Colo. 81009.

And for the snowmobiler looking for fun and action, the 1980 *Snowmobile Vacation Guide*, \$2.95 at Ski-Doo dealers, newsstands or from Bombardier Corp., Box 6108, Duluth, Minn. 55806, is a directory of resorts, trails and regions where snowmobiles can be rented—or bring your own—and special family vacation activities are available. **PM**





NASA Hits

A new invention by America's space agency will help all Americans save energy and make some companies very wealthy.

Exxon has it. So does about a dozen other manufacturers. And if our hunches are correct, a new space-age product invented by NASA may not only save Americans millions of dollars but make fortunes for the companies that sell it.

The new NASA invention uses the latest space-age technology to save energy. Your refrigerator for example, is a major energy user. With this new device, your refrigerator compressor will run quieter, there will be considerably less heat generated from the motor, and it will run more efficiently saving at least 30% in energy.

The invention requires no installation. Just plug it into your outlet and plug your refrigerator into the device.

OVER PRICED UNIT

But there's a catch. Most manufacturers sell the device for as much as \$200. Using it with your refrigerator, it will take many years before it will pay dividends. On a powerful motor, however, the device will pay for itself in a matter of months.

Manufacturers who have announced their units are selling them like hot cakes. Although you may have heard a great deal of publicity about the product, you may not have seen any advertising because most manufacturers are currently sold out.

Watch for it! We predict great success for all those associated with the product. The power-saving device invented by NASA is a big hit. It will grow in popularity and save energy and make many companies very successful.

A SMALL COMPANY

There is one small company however, that is credited with improving the device and developing it for the consumer market. Called ERI (Electronic Relays, Inc.) the company has developed several models to service specific products such as a refrigerator, a washing machine, dishwasher, swimming pool and a typewriter.

This small company actually improved the NASA invention by adding its own refinements. ERI had a great deal of experience in solid state relays which use TRIACs and integrated circuits—two important elements in the NASA invention. A TRIAC is a bidirectional thyristor which controls AC from a single control input. TRIACs also produce a great deal of heat.

ERI's experience taught them how to control the TRIAC and its heat dissipation and thus they were able to reduce the device's cost through more efficient handling of the heat problem. They were already one of the nation's largest purchasers of TRIACs—thus

their costs were already low.

NATIONAL PUBLICITY

They called their product, the Power Chopper and sent a sample to a national magazine for their review. In several tests, the device out-performed even the claims made by the manufacturer and the magazine ran a glowing article on their findings.

The manufacturer felt that the product might at first be misleading. Although it does save 30% on energy and in many cases up to 60%, ERI felt most consumers would expect a 30% reduction in their total electric bill—which of course the product will not do. Consumers will only get a 30% savings on the particular appliance used with the Power Chopper.

STILL PESSIMISTIC

The manufacturer also felt that the product was primarily for the industrial market—restaurants with large banks of refrigerators. The consumer must wait over one year before the device would pay for itself. And finally, the manufacturer did not feel that the consumer would respond in great numbers to the article which ran in the July, 1979 edition of a popular magazine.

Well, the consumer did respond. So much so that the small manufacturer, with absolutely no marketing staff, was buried with mail. The president of ERI called JS&A to help him out.

TEST ONE YOURSELF

We agreed to offer the Power Chopper to the consumer market for \$29.95—a major price breakthrough for the product.

Even if Exxon lowers their prices considerably, they'll never come close to the low cost of the Power Chopper. ERI's expertise with the TRIAC and JS&A's direct-to-consumer marketing, make the new NASA invention a practical power-saving accessory for every home.



The sophisticated electronics of the Power Chopper consist of a TRIAC, two integrated circuits and several solid-state devices.

We urge you to simply test just the refrigerator module. Order one from JS&A on a 30-day no-obligation trial. In the meantime, while you are waiting for your unit, feel the heat generated from the bottom of your refrigerator. Listen to the sound level of your compressor.

When the Power Chopper arrives, plug it in and notice how much quieter and cooler your refrigerator runs. See how much less time the compressor must run. The compressor not

only will run more efficiently but will save energy every day you use it.

AWARD WINNER

If after 30 days you are not convinced that the Power Chopper will save you energy and money while making your refrigerator run smoother, then just unplug it and send it back for a prompt and courteous refund, including the \$2.50 postage and handling. But if you've definitely noticed the difference, you'll want to purchase more units for the remainder of your motor-based appliances.

JS&A feels that ERI's technology, their improved NASA design and their low manufacturing costs will catapult them to the forefront of those introducing the new NASA invention. ERI's Power Chopper is one of the nation's major new innovative products and just recently won the Industrial Research IR-100 Award.

To order your Refrigerator Power Chopper, send \$29.95 for each unit plus \$2.50 for postage and handling to JS&A Group, Inc., One JS&A Plaza, Northbrook, Illinois 60062. (Illinois residents please add 5% sales tax.) Credit card buyers may call our toll-free number below. We'll send your Refrigerator Power Chopper, one-year limited warranty and you'll be ready to save. If you wish to order additional units for other appliances at \$29.95, you may, but we suggest you test the refrigerator module first and totally convince yourself.

GOVERNMENT REBATE

Purchase of the Power Chopper entitles you to a full 15% energy tax credit on your income tax return. It's like having the government give you a \$4.50 rebate.

JS&A is America's largest single source of space-age products—further assurance that your purchase will be backed by service for years to come.

NASA technology was responsible for the development of the integrated circuit and many other space-age products. Their latest product could not have been developed at a better time. Start saving and order a Power Chopper at no obligation, today.

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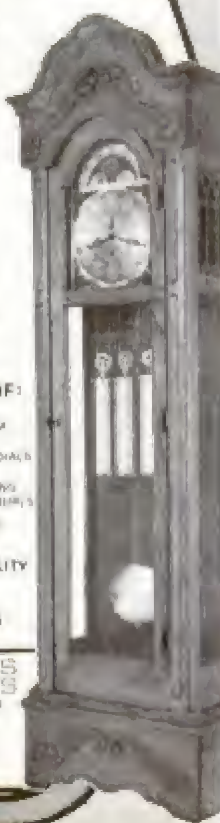
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It's easy to install an FM converter in your car



Diagram (left) shows how FM converter attaches between your car radio and car antenna. Photo (above) shows how easily under-dash installation is accomplished.

One of the cheapest and simplest ways to add FM to an AM car radio is a converter. It should take less than an hour!

by J. Raymond Trull

Want more variety in your traveling entertainment? Add an FM converter to your car's AM receiver! It's a quick task barely more complicated than locating your car's fuse box and using a screwdriver.

The converter becomes an electronic link between your car's antenna and AM radio. All FM signals are modified to an AM frequency—usually 1400 kHz—and fed to the AM radio via its antenna connector. When the converter is "off," the original antenna signal enters the radio for normal AM reception.

Putting the Audiovox FMC-IC converter to work in a Pinto—a quick four-step sequence—typifies procedures for most converters.

■ Mount the converter with self-tapping screws. (The lower skirt of

the dash is a convenient location.)

■ Switch the antenna lead from the radio to the converter and attach converter output leads to the AM antenna receptacle.

■ Connect the converter power lead to the fuse box accessory post or to another source of battery power. I tapped a lead intended for a clock or cigaret lighter that was not included in my economy-line car. The converter's own one-amp. fuse gives built-in overload protection.

■ Tune the radio to 1400 and select an FM station on converter's dial.

The only problem you may have is that a strong AM station right on 1400 would require that the converter be tuned to a different frequency. Doing so necessitates changing the AM radio to a slightly lower unused frequency and turning the converter's exposed tuning slug until the FM reception is best. Assigning one of the AM radio's pushbuttons for the converter frequency speeds switching to FM. The converter-fed radio produces good-quality sound and is largely free of static and hum.

Our converter retailed at \$13.88. Other brands range from about \$11 to more than \$35.

FM

FROZEN STIFF?



It's 10° outside . . . Even getting colder. So you bundle up in layers and layers of heavy clothes. First with long underwear. . . then bulky, restrictive thermalwear on top.

Oh, you were warm, all right. Like in a Turkish bath. Because you began to perspire from all your activity. And perspiring in that mountain of clothes is like perspiring in a plastic bag! The perspiration is locked in. So there you are. Wet and miserable.

But now, at last, Damart has solved the problem. Because Damart invented underwear that keeps you *warm, dry and comfortable* no matter how cold it is or how long you stay out. Underwear that's soft and light so you can move easily. Underwear knitted to let the *perspiration evaporate through* so you always stay warm and dry next to your skin.

Damart does this with a new miracle fabric — Thermolactyl. No other underwear does this! You can wear Damart indoors too, and turn your thermostat into the 60's. You'll feel perfectly comfortable and enjoy dramatic savings in home heating costs.

Damart will be supplying *The 1980 U.S. Winter Olympic Team* with Thermolactyl underwear! Damart is so comfortable that the Mt. Everest climbing expedition wears it. So does the Chicago Bears Football Club, New England Patriots and Philadelphia Eagles.

Our free catalog tells the full Damart Thermolactyl story and displays the whole Damart line for men and women, *including tall sizes*. Send for your **FREE** copy now!

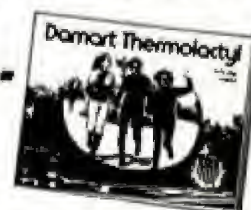


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SCIENCE WORLDWIDE

Flying laser-weapons lab

The bubble and turret atop an Air Force NKC-135 (right) presage advanced airborne weapons based on high-powered lasers.

The plane is the centerpiece of an Air Force research project to develop a laser-ray gun capable of burning through flying targets. The bubble houses classified equipment feeding a laser beam to a mirror system in the turret.

In combat, an aircraft equipped with laser weapons could fire lethal beams from target to target almost instantaneously. The system would eliminate the need to "lead" targets: It takes only six millionths of a second for laser light to travel a mile, and in that time an enemy aircraft flying at Mach 2 would move just an eighth of an inch.

Experimental lasers have been ripping into airborne targets for the past six years. The Air Force downed a winged drone over New Mexico in 1973, and the Army destroyed winged and helicopter drones above Alabama in 1976. In March, 1978, the Navy used a chemical laser to wipe out an antitank missile in flight over California.

Cloud over solar prospects

A California researcher has raised a small cloud over solar-energy prospects with his findings that solar devices in large cities may not work nearly as well as predicted.

Dr. Terry R. Galloway at Livermore Laboratory reports that urban pollution—dust, ozone, methane, carbon dioxide and nitrogen oxides—can scatter or absorb useful energy on its way to collectors in cities. Traditional methods of estimating solar energy available take dust into account, but ignore other pollutants. As a result, Dr. Galloway told PM, calculations in cities like San Francisco and Philadelphia can inflate the potential for solar power by as much as 30 percent.

Rolling out a new transmission

NASA is experimenting with a toothless transmission system that may some day carry power loads in gas-turbine cars, windmills, helicopters and rocket pumps.

Instead of gears, the new Nasvytis traction drives—named after inventor Dr. Algirdis L. Nasvytis—use smooth cylindrical rollers to transmit power. Rollers are ar-



Mirrors within rotating turret on Air Force plane direct laser beams at flying targets.

ranged like planets around a central "sun" roller. In speed-reduction designs, the power is transmitted from the "sun" through rows of "planet" rollers to an outer ring.

A variation of the design is currently under study for use in heavy-load, higher-speed helicopters. Roller transmissions might also work in automotive gas-turbine drive trains, planes and rocket

Loewenthal told PM that rollers in the system never actually touch. To reduce wear, they're separated by a thin layer of synthetic oil which instantaneously and temporarily solidifies when it comes under high pressure (up to 3000 pounds per square inch) between rollers.

Cows and quakes, continued

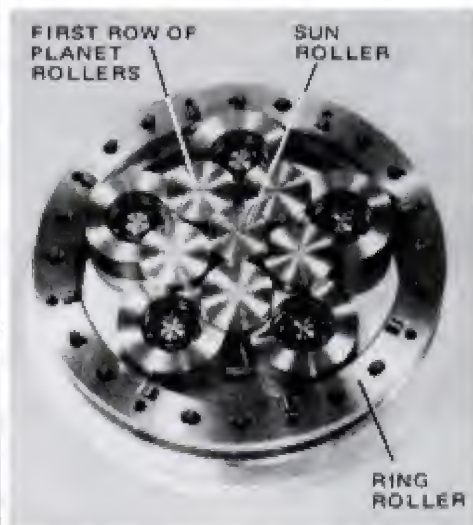
We reported here in August that researchers in California were collecting reports on odd barnyard behavior to see if animals could be used to predict earthquakes in the region.

The Chinese hold that animals become uneasy before humans can sense rumblings. The researchers at SRI International are investigating folk wisdom by taking calls from volunteers who phone in reports of animal unrest.

The SRI system was tested in early August when a quake measuring 5.9 on the Richter scale struck the San Francisco area. During the week before, SRI reports, 24 people from the central California region called about offbeat animal activity. That compares with an average of 19 calls a week since the experiment began.

"The increase is kind of interesting," one of the researchers on the SRI staff told us, "but it doesn't hit you over the head."

PM

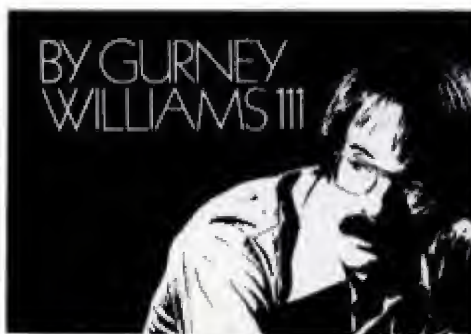


Look, no teeth: NASA's multiroller drive.

pumps. In windmills, they could be used to carry power from low-speed rotors to high-speed generators.

NASA reports that roller transmissions are less expensive because they need no gear-tooth cutting. They're lighter and smaller than conventional gearboxes. And they're quiet and almost vibrationless.

The traction-drive idea itself is not new, but most such drives in use handle loads no greater than 15 hp. Now, according to Stuart H. Loewenthal of NASA's Lewis Research Center, "we could come up with a traction drive to handle 20,000 hp—at least on paper."



Merit Switch On!

Low tar MERIT attracts increasing number of former high tar smokers.

Not too long ago, most smokers believed that low tar cigarettes simply didn't taste very good.

Then along came MERIT packed with 'Enriched FlavorTM' tobacco. And the "low tar, low taste" theory was exploded.

No other new cigarette in the last 20 years has attracted so many smokers as quickly as MERIT!

And it's convinced some of the hardest-to-please critics of low tar smoking: high tar smokers. In fact, over 70% of MERIT smokers are coming directly from high tar brands!

It's clear: MERIT taste is changing attitudes towards low tar smoking.

MERIT
Kings & 100's



Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

Kings: 8 mg "tar," 0.6 mg nicotine— 100's: 11 mg "tar,"
0.7 mg nicotine av. per cigarette, FTC Report May '78

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Adapted from: JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION



Technician puts slide in laser printer. Scanning process takes less than 20 seconds.

Now lasers help make better color prints from slides

A new machine uses lasers and electronics to do a job usually left to optics and filters.

by Tom Sahagian

A laser-based machine that helps make color prints from slides is the first step in what could be a revolution in photographic printing. Made by the Photo Electronics Corp. (PEC) of West Palm Beach, Fla., it is said to make prints with the sharpness and color fidelity of the conventional method at much less cost.

Other means for making inexpensive prints from slides exist, so what's the big deal?

There are basically two types of color film (not counting instant): negative film for prints and reversal film for slides. Most amateur photographers use negative film; it can be processed quickly and cheaply and yields handy-sized prints. Most professionals use reversal film because they want to project their images, slides are cheaper than prints, or they prefer the color.

PEC believes that prior to its LaserColor process, there was no quick, cheap way to make good prints from slides. Aside from Laser-

Color, there are four ways to make such prints. The traditional dye-transfer process is complex, time-consuming and expensive (an 8x10 print is \$200 or more), but because it allows maximum control, results are superb.

Much less costly are C-prints, made by taking a picture of the slide on negative film (called an internegative) and printing from the negative. Results are generally good, but suffer because the prints are second generation. Very inexpensive prints made with a "throwaway" internegative are available, but quality is poor.

The other processes make prints directly from the slide. R-prints, using chemicals and paper from Kodak, cost about the same as C-prints, but the quality leaves something to be desired. The Cibachrome process, which has attracted many boosters in recent years, compares in cost with C-prints, is known for excellent longevity and has been used exten-

sively for art reproduction. However, many people feel Cibachrome prints are too dark.

PEC says it can make prints with the fidelity and sharpness (but not necessarily the longevity) of dye transfers at the cost of C-prints. After seeing some impressive-looking laser prints in a New York gallery, PM decided to visit PEC in Florida to find out about its machine.

How it works

The LaserColor printer operates like this: After cleaning and inspection for flaws that might show in an enlargement, a slide is inserted into a holder and scanned twice by three lasers (red, blue and green) at once. The first scan records density range; the second, color information. The laser signals are converted to electronic signals, processed and fed back to the lasers. Then they scan/expose a frame of Vericolor II Type S 70-mm negative film. The process takes less than 20 seconds. An enlarger then makes a print from the laser-exposed negative the way it would with a conventional internegative.

If you're thinking that LaserColor sounds like a complicated way to make a conventional internegative, it is. While lasers are the glamorous part of the printer, electronic circuitry is its heart. Lasers provide tiny beams of spectrally pure light, which, for a 35-mm slide, translates into about 20 million optical bits of information per laser beam. But what the circuitry does with that information is the crucial difference between LaserColor and the other systems.

According to Alex W. Dreyfoos Jr., PEC president and LaserColor's codeveloper, the electronics are designed to convert the image on the slide to the information of the original scene. When circuitry drives the lasers to expose the negative, it's like taking the original picture.

That's a lot to swallow, so let's go over it. When you take a photograph, the film records the information of the scene, but not perfectly. If you take a picture of the picture (as when making an internegative), the imperfect information is recorded imperfectly. But suppose you knew that if a given film records a scene a certain way, you could work backwards and know what the original scene looked like. Then you could make an internegative essentially the same as taking the picture.

Dreyfoos claims the laser printer, with electronic circuitry, does just that. He says he can use electronics to make up for imperfect light ab-

(Please turn to page 58)



A LaserColor print is very close to color and detail of original slide. Note shadow detail in model's eyes and on her neck.

B C-print made with 4x5 internegative is good, but a bit too dark. Skin tones are off slightly and sharpness is reduced.

C Cibachrome print is dark, with reduced shadow detail. Sharpness is about that of A, but background color is off.

D R-print is not precise in color, lacks detail. Skin tones are too orange. Sharpness is less than that of other prints.



So-called Art Print takes advantage of the fact that, once the slide is encoded electronically, the information can be almost infinitely modified. The effect shown here, called TCP 999, is one of more than 3000 variants that are currently available.

The revolutionary Trail Cat

Bumps disappear under the advanced technology that Arctic applies to the trail with the 1980 Trail Cat. Trail Cat's remarkable suspension system is an Arctic first in the consumer sled market.

you've got a day's worth of riding ahead of you, you'd trade your sore and aching muscles in a minute for what Trail Cat has to offer.

In developing Trail Cat, Arctic Cat engineers took the sophisticated ride

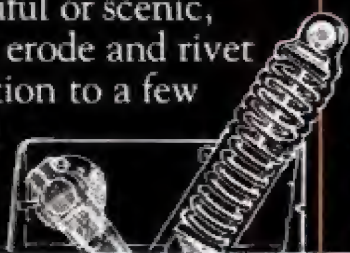
of the engineering magic that establishes and assures Arctic's superiority in the snowmobile industry.

Trail Cat is more than just a magical ride.

Assembled with all the care and good breeding that are the attributes of any Arctic Cat, Trail Cat purrs with agreeable accoutrements; illuminated gas and oil gauges; a choice of either 340 or 440 fan cooled, oil injected engines;

Slam Bam? No thank you, Ma'am.

Everybody knows the problem. Trails, no matter how beautiful or scenic, eventually erode and rivet your attention to a few impending feet in front of



External coil springs over shocks on the rear arm.

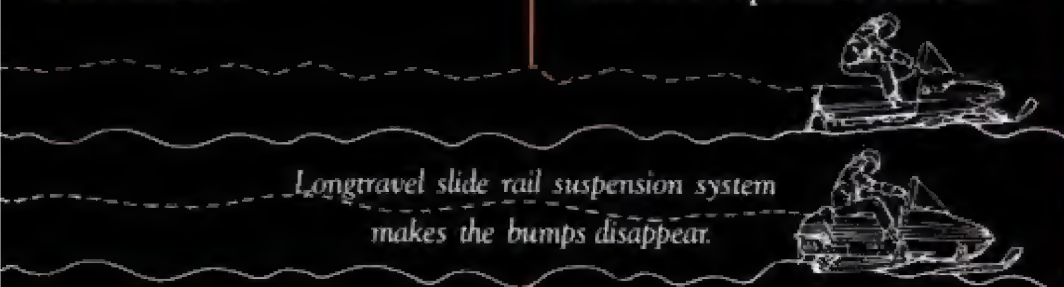
your snowmobile. The result is a ride that envies the main attraction at an amusement park. It can be fun for a while. But if

Coil springs over shocks

characteristics of other Cats one step further, utilizing a new long travel slide rail suspension system. Coil springs over the shocks up front on the skis combine with torsion springs on the front arm and external coil springs over shocks on the rear arm to produce a smooth and comfortable ride.

The predictable result will be competitive attempts to copy. But history's score card puts Arctic first with almost every major innovation in snowmobile technology. Trail Cat is only the latest example

Torsion springs on the front arm.



Long travel slide rail suspension system makes the bumps disappear.



Mogul Magician.

Electronic (CDI) normally
closed ignition; adjust-
able, padded handlebars;
parking brake; 60
watt, high intensity
headlamp; illumi-
nated rear
storage

compartment; hand sewn,
vinyl-covered, high
density urethane
and Ethafoam
padded
seat;

Mikuni butterfly carburetor;
a trail-stretching 7 gallon
fuel capacity; a $\frac{2}{3}$ cleated
rubber track with studs; and
optional electric start.

It's an impressive list.
It's an impressive snow-
mobile. It's an impressive
achievement in the
evolution of Arctic
engineering.

the
Cat
It's Black Magic

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The Atlas Band Saw • Handles cut-off operations in a wide range of metals — from steel and iron, to aluminum, brass and copper • Comes complete with ½ hp, 1725 rpm motor • Takes any shape stock — bar, flat, square, hex, tubing structural shapes, and cuts it at any angle from 90° to 45° Max. capacity is 4"x6" • 3-speed V-belt and worm gear drive offers speeds of 90, 155, 250 rpm • Swiveling rapid approach/release type vise allows fast set ups. Set desired cut, and spring control feeds blade at proper speed for smooth, fast cuts • Has stock stop for repeat cutting • *Converts to vertical position* for contouring, notching, slitting, and other operations in metal or wood. Length 41", height 37", width 16½". Extends to 43" length, 47¾" height in vertical position.

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NOW LASERS HELP MAKE BETTER COLOR PRINTS FROM SLIDES

(Continued from page 54)

sorption by film dyes so that exposing the internegative with lasers is as faithful to the original scene as exposing it with a camera!

Claims like that demand proof, so PM had several slides printed by LaserColor, Cibachrome, R-printing and C-printing and compared the results. We didn't make any dye transfers—they're too expensive for most people. All work was done by professionals experienced with the respective processes.

Each LaserColor print was superior to its competitors, though not always by a lot. In fact, all processes gave good results. But PM staffers were unanimous in their preference for the laser prints.

The C-prints generally were everyone's second choice. Color fidelity was good and sharpness okay, though below that of laser prints. Interestingly, the C-print negatives were 4x5 inches, much bigger than 70-mm LaserColor internegatives.

Cibachrome did well, but prints tended to be dark and a bit oversaturated. One slide taken in the subway was tabbed by a lab person "too dark" to print well, but the laser print of this slide was, if anything, better than the original. R-prints lacked color fidelity and shadow detail. It should be noted that Cibachrome and R-printing kits are available for home use, which can cut per-print costs considerably.

Not everyone thinks LaserColor fully lives up to its claims. Steve Dunwell, a professional photographer with two books to his credit, told PM he was disappointed with his experiences with LaserColor. He showed me some laser prints he'd ordered that lacked color fidelity, were decidedly unsharp, or both. He admitted, however, that a dye transfer of one of the same slides also came out poorly. And he has used a laser print in an exhibition.

The wave of the future?

Dunwell's experience helps point out that some claims for LaserColor may be a bit overstated, but it is a brand-new system and should be given a chance to mature. The basic concepts hold promise to be the dominant mode of photo processing in the not-too-distant future.

All other photo-processing systems are optically based, but regular noncoherent light can't make separate compensations in each one of a slide's three color-emulsion layers. However, laser light can. That, combined with the proper electronic circuitry, can result in a ma-

chine with incredible processing capability. Since film characteristics can readily be represented mathematically, a computer programmed with this information could take a photograph, even badly over- or underexposed, and make a perfect internegative. Or, once the slide has been read in, the information could be manipulated many ways, much faster and more accurately than with chemical or physical means.

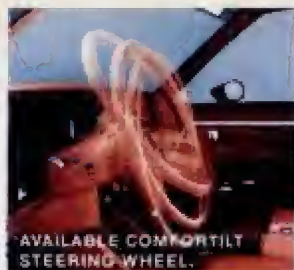
Basically, the laser printer does this now. It has programs for Kodachrome, old Kodachrome and all other chromes similar to Ektachrome. But there's no reason why it couldn't eventually be programmed for all films: reversal, negative and instant. PEC is now working on a direct printing process for lasers to expose photographic paper, skipping the internegative. Its not fully developed, but could become the snapshot printer of the future.

Going a step farther, the day will almost certainly come when cameras have solid-state electronic imaging sensors instead of film. Imagine a photofinishing system where you plug your imaging module into a unit that transmits the electronic information to the processor, which reads the information, manipulates it if necessary and then direct-prints your "photos" with lasers. If that sounds a bit too far out, it at least shows the potential of electronic coding of images.

The laser printer can now make straight prints and rescue many badly exposed slides (not usual with other methods). It can also make what PEC calls Art Prints—they resemble impressionistic paintings—at the flick of a switch. Such posterization with conventional methods is not very easy or cheap; with LaserColor it's as easy as making a straight print. PEC now offers over 3000 combinations of color and posterization; it even has video machines that let a customer preview combinations before ordering.

Press accounts of LaserColor have played up this posterization technique, but PM opinion was divided. The art staff liked the straight prints but were much more interested in Art Prints. Editorial types, lukewarm to Art Prints, were much more impressed by straight prints.

In summary, it seems that LaserColor, while not yet perfected, is well on its way to becoming an integral part of the photofinishing world. For price and product information, write PEC, Fairfield Dr., West Palm Beach, Fla. 33407. **PM**

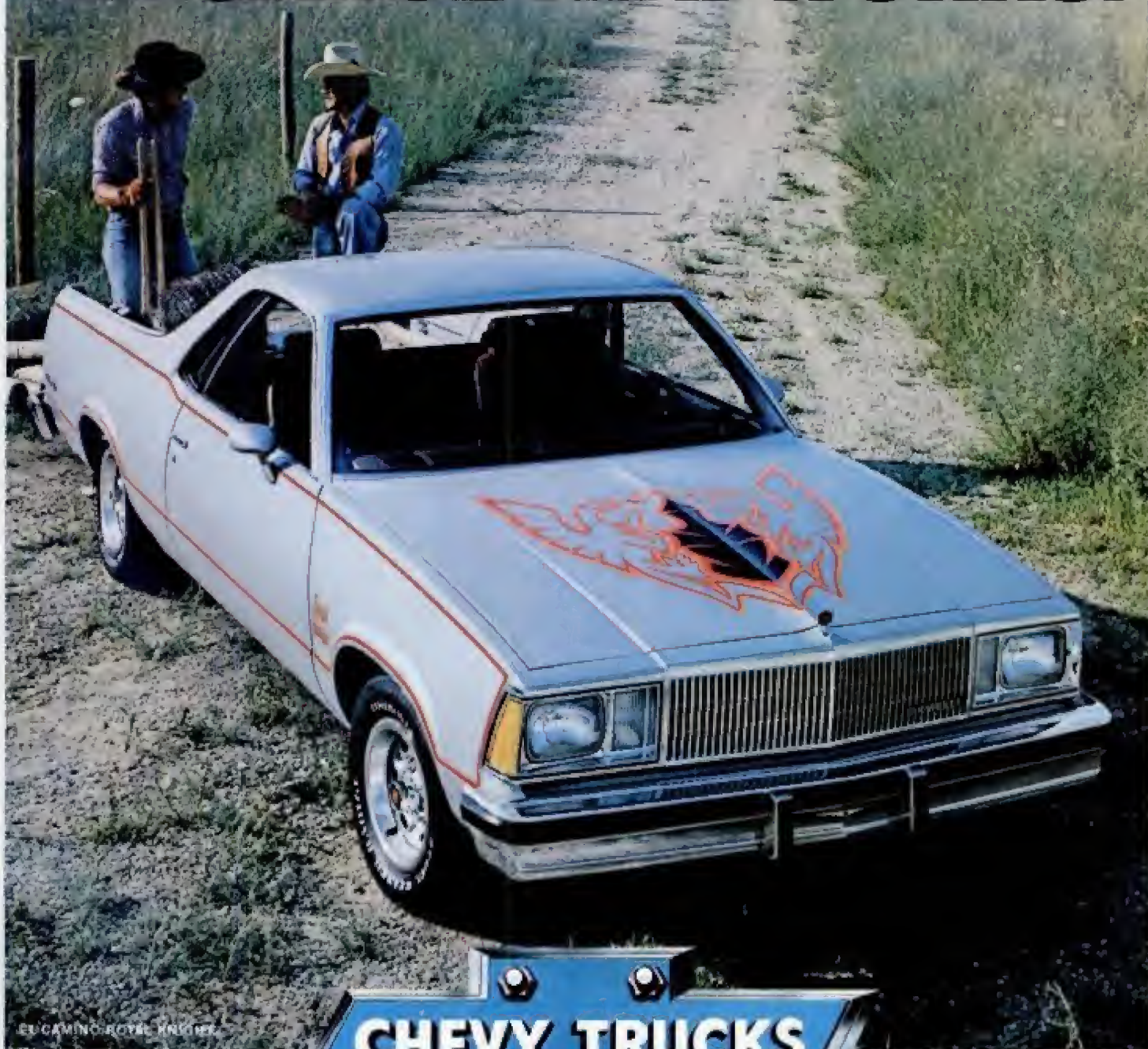


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94.8% of Chevy Light-, Medium-, Heavy-Duty trucks and commercial vans in the ten most recent years recorded were still on the job. (Based on R. L. Polk & Co. model year registrations through July 1, 1978. 1979 statistics not available at time of printing.)

CHEVY EL CAMINO. Here's a downright elegant and practical vehicle. Hard-working El Camino sports a 6½-ft. cargo box and payloads up to 1250 lbs., including cargo, equipment and passengers. Inside, it's surprisingly luxurious, whether you pick the standard interior or choose from a long list of available options. See and test drive one today at your Chevy dealer's. Many dealers can arrange leasing, too.

ELEGANCE THAT WORKS.



CHEVY TRUCKS

WORKSHOP MINICOURSE

THE DRILL PRESS



High-speed twist drills can be used for boring both metal and wood. When accuracy is especially important, you should use a bit with a brad or screw point.



From left to right, three excellent bits for boring accurate holes in wood—power bore, brad point and spade bit.



Always use a center punch to mark center of desired hole when drilling in metal.

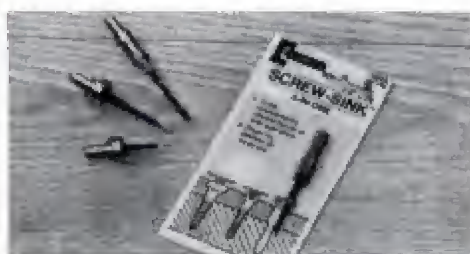


An old, but good stunt: Make your own sanding drum using a 1/4-in. dowel with one end silt and sandpaper wrapped around in the direction of the drill-press rotation.

In most woodworking shops, the cutters used in a drill press to make holes in wood are called "bits." Metalworkers refer to their cutting tools as "drills." There is a further distinction in names for the cutting task. "Boring" is generally applied to cutting in wood while "drilling" refers to metal cutting. However, it appears that the general usage today is the word "drilling." As an excarpenter, however, I confess to a preference for the word "boring" in wood.

Buy accessories as needed

Though there is a great variety of drill bits and accessories (for the



This drill-press accessory lets you perform several drilling steps at once: boring pilot and shank holes, countersinking and, on some versions, counterboring. Manufacturers such as Stanley, Sears, J.C. Penney and Ward offer these accessories.



Use a board with its center cut out when you must sand the full edge of a board. Here, the drum is long enough to sand 5/4-in. stock from edge to edge in one pass.



Three commercial and one homemade sanding drum will handle most DIY tasks.

drill press) to choose from, chances are that your shop arsenal will ultimately include 15 to 20 accessories—one each in a number of sizes, diameters, and so on.

For openers, outfit yourself with a set of twist drills for general shop work and add the superior wood-cutting bits as the need arises. Be aware that good bits do not come cheaply. In fact, many of the very fine ones can't even be found in your local hardware store and may have to be ordered specially from fine-tool catalogs.

Choose the right bit

Spade bits are available in most retail outlets and these are excellent when used for the task for which they're intended—heavy, rather than fine woodworking, such as in house carpentry.

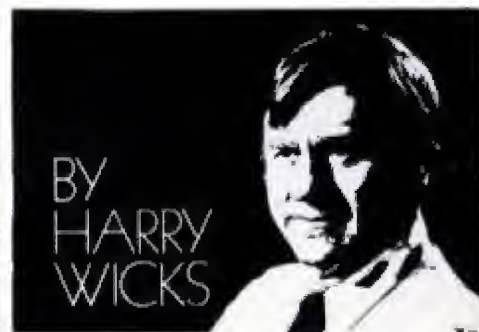
A Brad-point bit is a good choice for average tasks in a typical home (and commercial) workshop. If you stock several screw-point bits, make certain you use the feed rate specified by the manufacturer. The wrong one will lift the work from the table.

Many woodworking professionals partly file off the threads on a screw point so that the bit works more like a brad-point bit.

Quicker sanding

Most hardware stores carry a stock of various-sized sanding drums. Check these out and, because they are relatively inexpensive, add them to your collection as the need arises. The drum consists of a rubber cylinder mounted on a shank that is threaded on one of its ends to receive a nut.

As the nut (or in some cases screw) is tightened, it compresses the rubber cylinder slightly. The resulting slight bulge keeps the sanding sleeve from slipping off the drum during sanding operations. **PM**



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NEW NOW for outdoors

Snow-ped moped



A three-ski motor scooter will be introduced this winter by Chrysler. Due to be handled by its Marine Div. dealers, the little 72-pounder is claimed to slide along at up to 25 mph. Called a Sno-Runner, the midget snowmobile is pushed along by a cleated track inside the rear ski, driven by an air-cooled, single-cylinder, 134-cc engine. For car-trunk storage, the unit disassembles into three parts. Up to three hours of running is provided from the 1.3-gallon tank. Predicted price: about \$650.



Pull your car

A ramp hitch that raises drive wheels of a small towed car, the Mason Auto-Lift allows even a car with automatic transmission to tour behind an RV or truck. Tow bar slides up hitch bar, locks without jacking. About \$395 plus installation from PCI, 1975 South Blackstone, Tulare, Calif. 93274.

Soft-kick hot shot

Gas operation that cuts the recoil while using maximum-power magnum loads is the claim for the new \$400 Wildey Auto Pistol in 9 mm and 45 cal. manufactured by Wildey Firearms, Box 284, Cold Spring, N.Y. 10516. The pistol is recommended for metallic-silhouette shooting.



Gun guard

A new cushioned lock that can prevent the firing of any rifle, shotgun or handgun with a trigger guard is made by Michaels of Oregon, Box 13010, Portland, Ore. 97213, for safeguarding firearms. Once the unit is pressed in place over the trigger, a key is needed to remove it.



Tandem troller

For slow speeds or added safety with auxiliary power, a new outboard bracket from Sheyenne Marine, Box 218, Waynesville, Mo. 65583, mounts over sterndrive. Sterndrive's controls steer the outboard motor while a spring arrangement dampens torque.

Rabbit in snow

A lightweight snowplow originally designed for Jeep, Chevy LUV 4x4 and Subaru front-wheel drive is now available for VW Rabbit. At 260 pounds in steel, 200 in fiberglass, Sno-Way quick-disconnect plow is \$1395 from Sno-Way, 6102 West North Ave., Milwaukee, Wis. 53213.



Slip grips

If cups, dishes and ashtrays go skidding off tables and shelves aboard your boat or recreational vehicle, the Grippipad is reported to anchor them in place with a tacky but nonsticky grip. Imported from England by Pacific Coast Supply, Box 9074, Stockton, Calif. 95208, the discs, coasters and shelf liners cost from \$8.95 for the 8-inch circle, up to \$28.95 for 16x78-inch shelf strips that can be trimmed to size. Soup may slop going around a corner, but the mug won't.

Where quality drinks begin.



Drinks made with Seagram's 7 Crown taste better because Seagram's 7 tastes better all by itself. Make America's finest whiskey a part of your holiday entertaining. And enjoy our quality in moderation.

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Anyone for Tenons?



If your racket is tenons, doubles or singles, and you want a perfect match every time, you can learn from the professionals. They know a classic way to join two pieces of wood together is with a tenon that fits into a mortise.

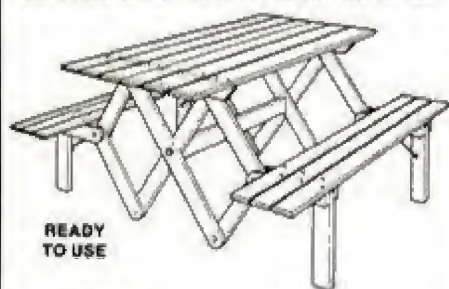
Fine Woodworking magazine speaks this language to more than 100,000 readers—people seriously interested in making beautiful things out of wood. Whether you are an aspiring novice or an accomplished expert, you'll find it an especially informative magazine, with finely detailed articles about techniques and tools, materials and design. It's written by master craftsmen who share their many years of wood-working experience. And it's printed on heavy paper to withstand years of reference. All back issues are in print and indexed periodically.

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Parking a bulky picnic table indoors when summer is over is practically impossible. So it sits in the yard or on the patio 12 months of the year. Not so with this unique design. Both table and benches fold scissor-fashion into an incredibly small unit which means the whole thing

can be stored in your garage or basement with room to spare. And if made of redwood, the table will last for years. To obtain plans and instructions for building this stowaway table send \$3.95 to Popular Mechanics Plans Service, Box 1014, New York, N.Y. 10019.



Before the first snow, check that shear bolts and engine-mounting bolts are tight.

Getting your snowthrower ready for winter

Now is the time to give your snowthrower some prewinter attention. Before you begin work, though, read your owner's manual to learn the parts and proper use of the equipment. Then follow these service tips suggested by Jacobsen, a manufacturer of snowthrowers.

Begin inspection by checking that shear bolts and engine-mounting bolts are tight, and that the engine-stop circuit is intact.

Lubricate machine parts

Use the diagram in your manual to locate parts. Some need lubrication before use. Remove the discharge chute, clean the flange's sliding area and apply water-resistant grease to the sliding surface and under the chute retaining washers. Also lubricate the sprocket, sprocket bearing, universal joint, and traction drive gears.

Apply SAE No. 30 oil to the side plates of the drive chain until it enters each roller and coats shafts. Oil the throttle cable and other parts as directed in your owner's manual.

Coat the collector shafts with water-resistant grease when re-mounting or replacing them. Remove the retainers and grease the bushings.

Give the machine a general once-over. Tire pressure should be 12 pounds per square inch (p.s.i.). Scraper blade should contact the plowing surface. Check for clean and tight wire connection to the spark-plug and for sufficient engine oil. To prevent snow and ice buildup, spray a coat of wax on the collector, collector housing, impeller, discharge chute and deflector.



Inspect your snowthrower impeller to make sure it is clear of all obstructions.



Apply water-resistant grease under the chute's retaining washers; also coat sliding surface, sprocket, sprocket bearing, universal joint, traction drive gears.



Lubricate entire length of throttle cables sheathed in metal coil-type conduits.

HINTS FROM READERS

Reinforcing an ax handle

This simple operation lengthens the life of an ax handle. Secure the ax head in a bench vise, bore a small, 1/2-in.-deep hole in the handle below the head and insert one end of No. 16 or other heavy-gauge wire into the hole overlapping the first wire turns, as shown, to insure a tight hold. Wrap the wire tightly on the handle to prevent slipping. Use 12 to 15 ft. of wire to complete the wrapping. To secure the other end of the wire, bore a small hole in the handle near loose wire end and insert it. Or secure the end by winding it around a small screw turned into the handle. Top the final wire turns with duct tape or nylon-reinforced strapping tape.

—William Moore



Overlap first wire turns to hold wire.



Strapping tape secures final turns.

Resealing caulking cartridge

Most of us know that sealing windows with caulking saves energy. But, often, a full cartridge of caulk is too much for one-time use. To keep left-over caulking from drying out, I remove the cartridge from the gun. Then, I melt paraffin or candle wax and dip the cartridge tip a few times in the wax to seal the tip.

—Charles R. Bissell

Some insurance agents offer the policies of a single insurance company. And that's okay.

But Insurance Store agents are independent. So they're free to offer you all the policies, coverages and services of *many* leading companies. Which gives you a better chance to choose the plan that's best for your special requirements.

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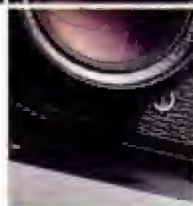
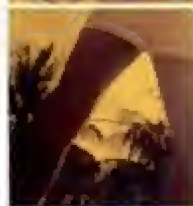
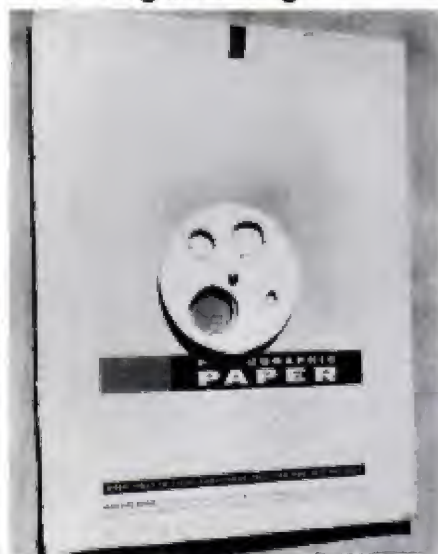


PHOTO HINTS

Something's burning



A simple burning-in tool can be made from two pieces of cardboard and a paper fastener. In a piece of cardboard about 11x14 inches, cut a hole the size of a half dollar about 3 inches from the center. Then cut a disc large enough to accommodate a series of holes ranging from half-dollar to pencil size. Clip the two pieces together with a paper fastener; rotate disc to the hole best suited to the work.—*Bob Berger*

Extension cord is lifeline

The rechargeable batteries in a flash unit can go dead at inopportune moments. Even if you carry the a.c. adapter around, its cord is often too short to allow freedom of movement. Keep a long extension cord in your car so it's there when needed.—*Margaret Shauers*

No more hen tracks

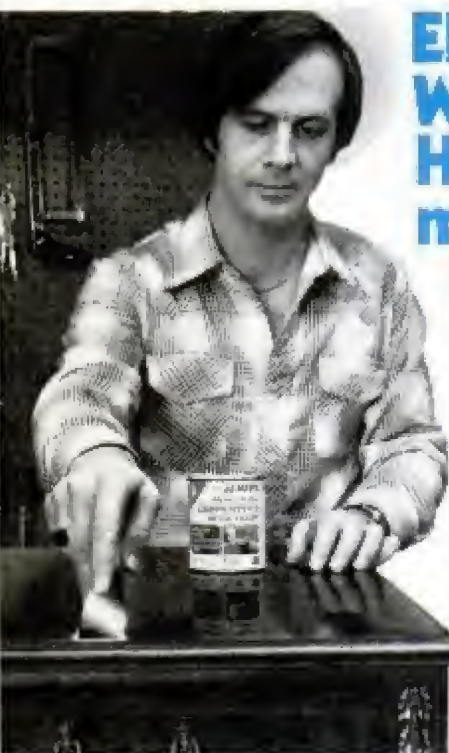


Annoyed because fingerprints show up unexpectedly on your enlargements? Handle negs with a pair of tweezers about 5 inches long; the kind stamp collectors use are fine.—*Robert Hertzberg*

Elmer's Carpenter's Wood Filler. How the pros make it look easy.

Ever wonder how the pros do it? With Elmer's® Carpenter's Wood Filler. It's easy to "work" and won't pull out while being applied. And it gives a smooth application that reduces sanding time. Besides, you can sand, drill, nail, cut, varnish or stain Elmer's. And its special latex formula resists cracking and shrinking. Of course, Elmer's is safe and non-toxic,* moisture and solvent repellent, and workable up to 10 minutes. It even washes up with water before drying. Now that's clean and easy.

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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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No alternative

The other day I saw a mechanic disconnect the battery lead while running an engine at a fast idling speed. His explanation was that if the engine keeps running, the alternator is producing current for the ignition circuit and is, therefore, working properly. Is this an accurate way to test an alternator?—Thomas King, Niles, Ohio.

No. The procedure does not prove an alternator is in perfect shape. Most alternator stators have three sets of windings and three sets of rectifier diodes. If one of the windings or diodes has gone bad, the alternator will still produce enough current for the ignition circuit, but won't produce enough current to keep the battery fully charged. The most accurate way to test an alternator, therefore, is with ammeter, voltmeter and ohmmeter, as we've been doing all along.

There's another angle to this. Suppose the alternator is in good condition. Disconnecting the battery lead may damage it. Allowing an alternator to operate without a battery lead can cause a rise in voltage that puts stress on the alternator windings. Furthermore, when the battery lead is disconnected, a high voltage spike is induced in the electrical system. This spike, which can reach 150 volts, may damage diodes, as well as the regulator. When the battery lead is reconnected, another spike is produced. All in all, disconnecting the battery lead with the engine running is not a good idea.

Loose hood's had it

The hood of my 1978 Zephyr is loose. It rattles. What can I do about it?—Arthur Dewitt, Peoria, Ill.

Readjust it. Here's how:

1. Raise the hood.
2. Loosen the locknuts on the two hood bumpers and lower the bumpers.
3. Loosen the two hood-latch retaining screws. Then move the hood latch until you get a flush fit between the top of the hood and fender,

as you apply upward pressure to the front of the (closed) hood. Now, tighten the hood-latch retaining screws.

4. Raise the two hood bumpers, so there is no movement (looseness) at the front of the (closed) hood. Now, tighten the hood bumper locknuts.

5. Check hood operation and alignment by opening and closing the hood a few times. You can use the same procedure to adjust the hood of a Ford Fairmont.

Fresh breath

I own a 1978 Chrysler Newport which has had a surge at idle since the day I bought it. Trips to the dealer, resulting in several engine tune-ups and countless adjustments, have failed to smooth the idle. The dealer now contends that this car has an inherent poor idle, and any more complaints on my part are a waste of breath. I still say that an expensive car should not act this way. Your suggestions would be welcome.—Norman Arden, Lake Charles, La.

I agree with you, Norm. So does Chrysler. An advisory from the company outlines a possible cure for the problem.

The trouble may lie with the vacuum signal sent from the carburetor port to the four-port fuel tank charcoal canister. On signal, the charcoal canister is supposed to "dump" gasoline vapors, through a purge valve to the carburetor, for burning in the combustion chambers. It's been found that, in some Newports, the signal has been prolonged, leading to an increased flow of vapors from the canister to the carburetor. This throws the idle mixture off and causes rough idling.

Solving the problem involves installing a vacuum reducer (part No. 4095139) in the vacuum hose, between the carburetor and canister. The vacuum reducer is designed to readjust the vacuum signal; that is, it will delay the opening of the purge valve in the fuel tank canister.

Be careful when installing the vacuum reducer. The Newport is equipped with two vapor canisters, and you must get the reducer in the correct vacuum line. Facing the front of the car, remove the extreme right-hand vacuum line from the canister on the right. Place the vacuum reducer in this line.

Fast aid

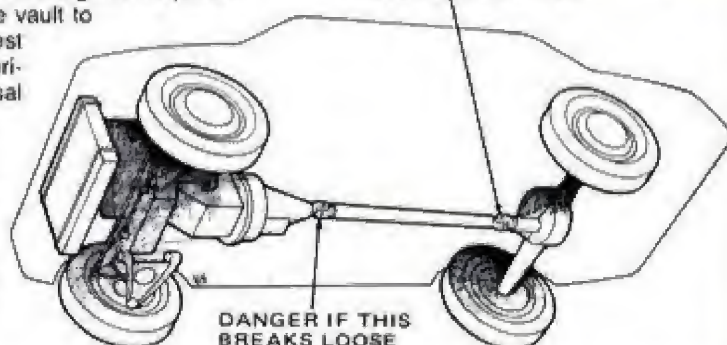
I need help—fast. In four years' time, my 1975 Pontiac LeMans with 350 cu.-in. engine has needed three High Energy Ignition (HEI) modules. Now, because my car won't start, a mechanic says I need a fourth. Tell me—can I switch from this pain-in-the-neck system to conventional ignition?—Sheldon Weiss, North Miami, Fla.

Sure you can, but don't. There's no need to go through this needless expense, or so I believe. Because of the

(Please turn to page 72)

Dangerous pole vault

A driveshaft that drops as a car speeds down the highway could be one of the most serious hazards a driver faces. It depends on which end of the shaft falls. If the shaft breaks loose from the rear universal joint, power is lost and the car can't be driven. While it's inconvenient, the outcome isn't as serious as having the driveshaft break loose up front. If that should happen, the shaft can dig into the pavement and act as a pole vault to flip the car over. The best cure is prevention. Periodically check universal joints for looseness. Lubricate them if they aren't sealed. If you hear noise from the joints, which may be accompanied by vibration, don't drive the car at high speed until you check it out.



PM CAR CARE
TIP

CAR CLINIC

(Continued from page 71)

number of complaints *Car Clinic* has received concerning "bad" HEI modules, I discussed the situation with GM engineers. I was told:

"Most times, when a problem seems to be the result of an HEI component, the cause is poor connections—not a component—especially if the problem occurs in the low voltage circuit, consisting of the pick-up coil to module connections."

When it comes to what seems like module failure, therefore, here is what you should do before condemning the module:

1. Remove the module.
2. Clean the module terminals with an emery cloth or a wire brush to remove oxide film. Then, coat the terminals with a thin layer of petroleum jelly.
3. Remove the connector body from the pick-up coil lead. Flow a little solder between the spade connectors and the wiring to assure good contact, but use the soldering tool carefully. Don't let heat damage insulation.
4. Squeeze the side rails of the spade connectors with needle-nose

pliers so they will make a tight fit between connectors and terminals.

5. Apply a small amount of silicone heat-transfer grease to the base of the module. You can get this grease from a GM dealer by referring to AC-Delco part D-1920.

6. Install the module and reconnect leads. See that all terminals are seated tightly and metal-to-metal contact is secure.

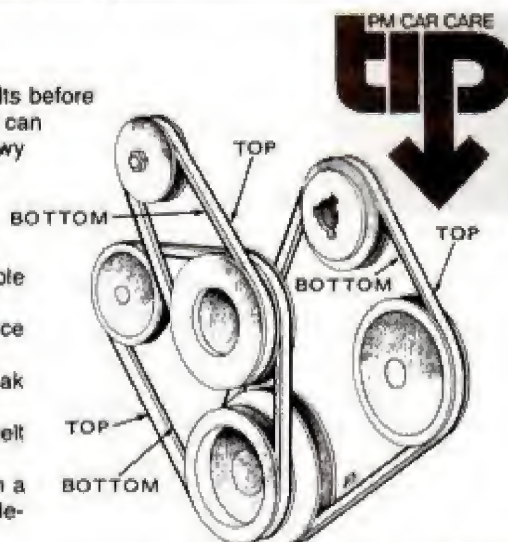
Missed the mark

My 1977 Ford LTD with 302-cu.-in. engine and automatic transmission was recently worked on by a Ford mechanic to replace the transmission front pump seal. The job had to be done because of a bad leak. I now see evidence of the same leak. Transmission fluid is spreading out along the transmission case. What did the mechanic do wrong?—William Wilcox, Kansas City, Mo.

Repeat story

You've heard it before: Check the drive belts before winter sets in, and avoid breakdowns which can be particularly uncomfortable on a cold, snowy day. However, *what part* of the belts you check is quite important. Belts may look okay topside, but they frequently fail from the inside out. Therefore, be sure to look at the bottom edge of the belts for these trouble signs:

- Glazing—A slick, hard (glazed) surface slips, causing engine overheating.
- Cracks—Small cracks enlarge and break through as a belt flexes.
- Peeling or splitting rubber—A frayed belt will soon fail.
- Soft rubber—Oil and grease that get on a belt cause the material to become soft and deteriorate.



TROUBLE SAVER.

New Duro™ E-POX-E® 5 glue in the Quick Mix™ Syringe takes the guesswork and the mess out of epoxy gluing.

The new Quick Mix Syringe measures an equal amount of E-POX-E 5 resin and hardener every time. There's no measuring and no waste like you get with two-tube epoxies. With the Quick Mix Syringe, you use only what you need.

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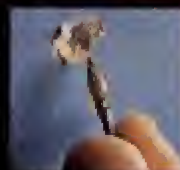
Yet it bonds in only 4 to 6 minutes.

Save trouble. Save time. Save mess. Duro E-POX-E 5 in the new Quick Mix Syringe is one of the fine Duro family of household and automotive repair products.



NEW IDEA: 1. Coat screws or nails into drywall or paneling with E-POX-E 5. Add structural strength — fasteners hold better, longer.

2. Where fastener has pulled out, E-POX-E 5 can fill hole, hold new fastener in.



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Cleveland, Ohio 44128



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The Dry Look[®] leaves hair feeling as soft and natural as it looks.

The Dry Look gives you more than a great look. It leaves your hair feeling soft and natural, too — not too stiff. The Dry Look in pump spray or aerosol — with a formula that's right for your hair. Get The Dry Look... and don't be a stiff!

©The Gillette Company, 1979



Available in pump or aerosol.

He probably made a wrong diagnosis and an unnecessary repair. Before tearing into the transmission, he should have cleaned off the transmission case and run the vehicle to induce leakage. Usually, a leak past the front pump seal is verified if oil shows up inside the converter housing. If oil is simply spreading over the case, the oil-cooler-line fitting is probably leaking. This leak can be stopped by replacing the fitting with a new one and torquing to 15 to 20 foot-pounds, which is a lot easier and less expensive than it would be if you were replacing a front pump seal.

It's important not to try and stop a leak by tightening the fitting beyond specification. If you do that, transmission case threads may be damaged.

Wintertime cocktail

Ever since my 1976 Volvo 242 was new, I've been having a wintertime problem. When driving short distances, making frequent stops, gasoline gets into the crankcase and dilutes the oil. A few hundred miles of this raises the oil level from normal to ½-in. above the Full mark on the dipstick.

Getting the engine warm by a long

drive on the interstate evaporates the gasoline and brings the oil level back to normal. Unsuccessful attempts have been made by Volvo mechanics to cure the trouble, which does not occur in warm weather. Is there a cure?—Hans H. Renner, Conway, N.H.

The usual cause of oil dilution, which occurs when excess gasoline washes down cylinder walls into the crankcase, is an over-rich fuel mixture, coupled with short-trip driving in cold weather. Have your mechanics checked choke function, tried adjusting the choke to a leaner setting, seen to it that the carburetor air cleaner is not obstructed, tried readjusting the fuel mixture, and made sure the cooling system thermostat is working properly? If they have done all this, then the only way to keep diluted oil from causing premature engine wear is to change the oil and oil filter frequently during the winter.

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

SERVICE AND SAFETY

■ According to the Tire Industry Safety Council, "Mud and snow tires should always be mounted on the axle that propels the vehicle in order to gain the extra traction that these tires provide." Thus, if you own a car with front-wheel drive, you should put snow tires on the front wheels.

If you have a four-wheel drive vehicle, put snow tires on all four wheels to get maximum traction.

But if yours is a "conventional" (rear axle) vehicle, just install the snow tires on the rear wheels.

■ Chrysler cautions that power-steering, pump-belt tension has a "great effect on pump life and performance" of the 1978 and 1979 Challenger, Sapporo and Colt station wagon. Belt tension should never exceed the specification of the manufacturer, which is from ⅝-in. to 2⅝-in. when the belt is depressed at its midpoint from above with a 22-pound pressure.

■ If the clutch pedal binds in a 1977 or 1978 Ford F-100, F-150, F-250, F-350, Econoline or Bronco, have a newly designed release bearing that's known as part No. D7TZ-7548-C installed.

■ Be careful when gapping sparkplugs in a 1979 Buick with V6 turbocharged engine. The specified gap is .040-in. The plug gap for V6 engines without turbochargers is .060-in. This is a considerable difference, so be sure not to confuse the two.

PM

Stanley passes the buck to you.



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Right now is the best time to get that Stanley Handyman® Saw you've been thinking of. Because now when you buy one of our quality saws, you'll get a "Saw Buck" back in the bargain (\$1.00 for one-piece molded handle, \$1.50 for wood handle—plus 15¢ postage). Purchase any specially tagged Stanley Handyman Saw from your participating Stanley dealer. Then send the special Saw Buck tag with register receipt and coupon to Stanley, and you'll receive your cash rebate through the mail. But hurry, this offer ends June 30th, 1980.

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Cut me in.

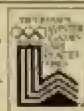
Please send me ☐ \$1.00 / ☐ \$1.50 against the purchase price of my new Stanley Handsaw. Special "Saw Buck" tag and register receipt attached. Send to Stanley Tools, P.O. Box 3000, Dept. PM, New Britain, CT 06050.

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THE TOOLS THAT
HELPED BUILD
THE OLYMPICS

PM LOOKS AT PADCO PRESSURE PAINTER

After seeing Padco's paint pad in the November '78 *PM Workbench*, readers wrote for more information. So, we decided to give the device a closer look. The unit proved to be a timesaver for covering interior, as well as nonrough-sawn, exterior surfaces with latex paints and stains. However, it is not designed for extremely thick, dripless or oil-base paints.

To use, fill the tank and pressurize it with 20 or 30 pump strokes. Paint flow is activated by depressing a button on the handle and stopped by releasing the button. A sliding lock on the handle underside depresses the button to provide continuous flow.

To clean the unit, connect the back-flush attachment to the end of the applicator-feed hose and then to a garden-hose faucet. Flush with water until it runs clear. A garden hose adapter, necessary to connect the back-flush



Hand-pressurized painting unit, made for water-soluble paint, lets you work without constantly reloading the applicator.



Complete kit includes tank with hand pressurizing pump, back-flush attachment, applicator, pads, hose, funnel.



Pressurize by stroking the pump. Paint gradually fills hose and saturates pad. Relief valve prevents overpressurizing.

attachment to standard kitchen or bathroom faucets, is available at many hardware outlets. The self-sticking pad may be cleaned with detergent and water, or replaced.—*Rosario Capotosto*



Remove the pump assembly to fill the 1-gal. tank with paint. Don't try to use extremely thick, dripless paint or oil paint.



Regulator button on applicator lets you control paint flow. Sliding lock secures it in open position for continuous feed.

SPECIFICATIONS—PAINTER

Tank: plastic, 1-gal. capacity.
Hose: 15-ft., clear, flexible plastic.
Replaceable pads: nylon-flocked, pressure-sensitive.
Price: \$75.
Manufacturer: Padco Inc., 2220 Elm St., Minneapolis, Minn. 55414.

Is ion deficiency a threat to your life when you drive?

Do you lose your temper or your judgment or even your concentration when driving? If you do, it may be because you're breathing unbalanced ion-starved air.

Think of it this way. When you're walking in the mountains or by the seashore the negative-positive ion balance in the air is ideal, with negative ion density between 2000/4000 per cubic centimeter. (In a moving car or other vehicle there is usually only 80-100 negative ions per cubic centimeter. And far too large a proportion of positive ions.) The important thing is: Negative ions are good for you and help you; positive ions make you grumpy and tired and affect your judgment.

Now, space age technology has produced the **Bionaire 300** so small it fits into the palm of your hand and weighs only 4 oz.



The **Bionaire 300** fits on your dashboard without obstructing your view. No interference with your radio or CB. Keep your windows open or closed.

The **Bionaire 300** has 100% solid state circuitry. No moving parts to wear out. Tested in the coldest Canadian weather, it is built to give you many years of maintenance-free service. It has a multi-point ion source and provides the highest ion output of any self-contained unit of its size.

The **Bionaire 300** can be used with total peace of mind. No exposed high voltage wires, no sharp corners, no light reflecting surfaces to distract you.

The **Bionaire 300** is completely self-contained, so no under-dash power pack is needed. You don't drill or tap the ignition coil. To install, simply attach the two-wire connection to your fuse box or ignition system. The unit operates automatically when you switch on the ignition. The solid state pilot lamp tells you it's working. **Bionaire 300** uses exactly 1/2 watt D.C. power. It may well be the best investment in car safety you ever make.

New! A home-office unit the size of a cigar box that is efficient for a 15' x 15' room.

**B-V Distributors, P.O. Box 510,
Grand Island, New York 14072 Dept 103**

I'm sold on healthy, energized air in my car or home. Please send me, delivery included, for a complete money-back 21 day trial:

- ☐ The **Bionaire 300** (for my car) at \$99.00
☐ The **Bionaire 100** (home-office unit) at \$139.00
(N.Y. and Ontario residents add sales tax)
I may return either item undamaged within 21 days and get a full refund if I am not satisfied. I enclose my ☐ check ☐ money order for \$_____ or, please charge my ☐ Visa ☐ MasterCard ☐ American Express.

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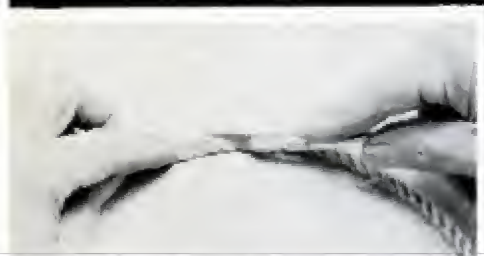
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Coiled rope: A unique way to dress up your table



Cut the rope diagonally in the direction of the twist, so it has a tapered end.



Saturate between strand ends with glue. Taper with fingers covered by wax paper.



Follow the natural curve of the rope as you glue it to vinyl upholstery backing.



When the place mat is complete, trim off excess vinyl, so rope conceals the edge.



Begin winding at the candleholder base. Apply glue to rope and press in place.



Rope craft is an enjoyable pastime that you can use to add an attractive nautical look to your table setting. Here are directions for making place mats, napkin rings and candleholders. Once you've mastered the techniques, other projects will come to mind.

Basic technique

To begin work, diagonally cut off the rope tip following the twist of one of the three strands. Using a glue gun, saturate the end with glue. Protect your fingers with wax paper or plastic gloves and twist the rope end into a smooth taper in the same direction as the strands.

Use plenty of hot glue to attach the rope to a surface. For example, a $\frac{1}{8}$ -in.-dia. bead attaches $\frac{1}{4}$ -in.-dia. rope. Work a 2- or 3-in. length at a time, so you can place the rope in hot glue 10 to 15 seconds after the glue has been applied and before it begins to cool and set. Hold the rope in position for almost a minute. If the glue sets before you're ready, cut it off with a knife or reheat it with the gun's hot nozzle.

Utilize the natural curvature of the rope, allowing it to follow the shape of the object. Rest the gun against previously glued rope to guide the bead for the next coil. When you're near the end of a project, determine where the rope will end. Then cut the rope and taper

the end with glue before you complete the last coil.

Place mats

To make a 13×18-in. oval place mat, you'll need about 50 ft. of rope. Tightly tape a 15×20-in. piece of fabric-backed vinyl upholstery to a work surface, face down. Square-cut one end of the rope, treat it with glue, and pinch the end fibers together. Lay a $\frac{1}{8}$ ×4-in. bead of glue in the center of the vinyl, parallel to the long axis. Position the first 4 in. of rope and hold it in place. Follow the natural curve of the rope and glue an adjacent segment, making a very tight bend. When you finish, trim off the excess vinyl.

Candleholders

With the candleholder sitting on its own base, start work at the bottom by laying a 2-in. bead of glue on the tapered end of the rope. Press the rope into place at the base. Continue gluing and winding.

Napkin rings

Begin work by hacksawing 1½-in.-long sections of 1½-in. o.d. PVC pipe. Sandpaper the ends and outside surface. Start the rope coil on one end and gradually work to the outside and to the other end, completely covering the ring.

How-to instructions for more rope craft projects are available from the Bostik Consumer Div., USM Corp., 4408 Pottsville Pike, Reading, Pa. 19605. **FM**

SUPPLIES

Materials: $\frac{1}{8}$ -in.-dia. Manila rope, as smooth as available, with fewest visible fibers; wax paper; fabric-backed vinyl upholstery material; plastic dime-store or old candleholders; 1½-in.-o.d. PVC plastic pipe; masking tape; 80-grit sandpaper.

Tools: Bostik's Thermogrip Electric Glue Gun or other glue gun with hot-melt glue sticks; utility knife; tape measure; scissors; hacksaw.



Napkin rings are short lengths of PVC pipe covered with coils of glued-on rope.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

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FILTER 100's: 10 mg. "tar", 0.8 mg. nicotine, FILTER, MENTHOL.
11 mg. "tar", 0.8 mg. nicotine, av. per cigarette, FTC Report MAY '78.



The Vantage Point

Where great taste and
low tar meet.



Great taste once belonged
only to high tar cigarettes. Not
any more. The secret? The
specially designed Vantage filter
works together with our rich
'Flavor Impact'™ tobacco blend
to deliver satisfying flavor in
every puff. That's Vantage. Low
tar with a uniquely satisfying
taste. And that's the point.

Regular, Menthol and Vantage 100's

NEW NOW for home and shop



A



B



C

A Motoraser is an electric erasing machine designed for heavy use. The housing is made of lightweight Lexan, which resists cracking or chipping if dropped. The eraser is 16 percent lighter than competitive products and, since it is double-insulated, it offers the safety advantages of a grounded appliance without having to use a three-prong adapter plug. It is at artists' and drafting materials stores, priced at \$50. Keuffel & Esser Co., 20 Whippany Rd., Morristown, N.J. 07960, is the manufacturer.

B Poulan's model LTA 400 line trimmer attachment converts a gasoline-powered chain saw into a nylon line trimmer. It has a .080-in.-dia. nylon line that cuts a 17-in.-wide path. The trimmer sweeps, edges and mows grass and weeds. For use on most major brands of lightweight chain saws, the nylon line trimmer attachment is priced at \$70. Beard-Poulan, Box 9329, Shreveport, La. 71109.

C By providing an elevated clamping area on the press table, the drill press clamping fixture solves the problem of how to hold various materials for drilling. The fixture, designed for use with lever-jaw pliers as clamps, is especially helpful for holding small workpieces. Made of steel and angle iron, it is bolted to the drill press table. It's available for \$34.95, including postage. Safety Speed Cut Mfg. Co., 13480 North Hwy. 65, Anoka, Minn. 55303.

D This hardwood veneer mantelpiece is designed for use with most major-brand, factory-built fireplaces. The top and side plywood support pieces are located and nailed to the wall, then the face pieces are simply snapped in place by hand. They're available in three styles, unfinished, from \$200, and in dark pine or antique white, from \$235. For installation over brick, slate and other noncombustible materials. Rustic Crafts, 65 West Sheffield Ave., Englewood, N.J. 07631.

D



The International Society of Postmasters announces
OFFICIAL GOLD ON SILVER PROOFS OF
The World's First Stamps



The "Hermes Head" was the first stamp of Greece. It bears the denomination of 1-lepton and portrays Hermes, winged messenger of Greek mythology.



The steamship on the 1 real stamp of Peru represents the method by which mail was delivered in that country when its first stamp was issued in 1857.



The famous Penny Black of Great Britain, the world's first postage stamp. It bears a classic portrait of the young Queen Victoria.



Guatemala's first stamp is based on its Coat of Arms. The sun symbolizes liberty. The branch of live oak, patriotism. And the laurel branch, victory.



Portion of Guatemalan stamp enlarged to show fine detail in gold on sterling.



The 2-skilling "crowned numeral" design of Iceland was based on a Denmark stamp. Only 40,000 were printed—and they are extremely difficult to come by today.



"Liberty Seated" is the theme of the first stamp of Liberia. Based on a British colonies design, it differs in that the helmet has become a cap, and the figure is on a stone jetty.



1-shahi "Tiger's Head" of Afghanistan.



The 1-candareen stamp of China is identified by its "Imperial Dragon" motif. The Chinese characters stand for the Great Tsing Dynasty.



Bolivia's first stamp, the 5 centavos, depicts a condor—the large bird native to the Andes—perched on a globe. Philatelists call it the "Condor Issue."

Gold on sterling stamps shown actual size.

A definitive collection of 73 historic stamps—the first stamps ever issued by the 73 nations that were the first to issue postage stamps. Authentically re-created in 24kt gold on sterling silver.

IN THE YEAR 1840, the first postage stamp in history was issued. It was a stamp of Great Britain, which came to be known as the 'Penny Black'. This historic stamp was destined to change the course of life throughout the civilized world. For it heralded the issuance by other countries of their own stamps—and eventually resulted in an international postal network linking peoples in every corner of the globe.

Now, the International Society of Postmasters will pay official tribute to the first stamps of the world by issuing an unprecedented collection.

Authentic re-creations of world's first stamps
Working from the *actual* stamps themselves, the sculptors of The Franklin Mint will re-create the designs for these historic stamps, capturing all of their distinctive features. Then the mint's master craftsmen will strike each gold electroplate on sterling silver stamp in flawless Proof quality.

The result will be a collection of *entirely accurate* replicas of stamps that are among the most significant in history. Stamps considered among the world's most interesting philatelic treasures.

Officially authorized and authenticated
To certify that each gold on sterling stamp bears the approval of the International Society of Postmasters, the official symbol of the Society will appear on the reverse of each minted stamp—and the designation *24kt gold on sterling silver*.
So that each subscriber will be able to display the collection at home, a custom-designed hardbound album will be included as part of the collection. And a special magnifier will be provided to study the stamps in detail.

Issued in limited edition
The World's First Stamps will be issued in limited edition—and it is being made available *only* until the end of this year. After that date, it will never be offered again—anywhere in the world.

The collection will be issued at the convenient rate of one per month, and the guaranteed issue price for each 24kt gold on sterling stamp is just \$19.50.

To acquire this important new collection, your subscription must be entered by December 31, 1979. Mail the application at right to the International Society of Postmasters, c/o The Franklin Mint, Franklin Center, Pennsylvania, by that date.

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Enter my subscription for The World's First Stamps, issued by the International Society of Postmasters, and consisting of seventy-three 24kt gold on sterling silver proof stamps to be sent to me at the rate of one per month.

I need send no money now. Bill me \$19.50* for each gold on sterling silver proof stamp in advance of its shipment.

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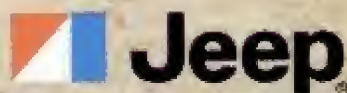
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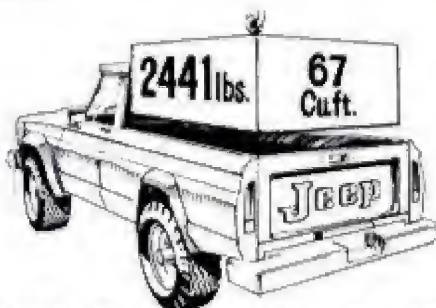
Jeep Truck



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on 4-wheel drive

Rugged. Durable. Tough. Dependable. Go-anywhere and do anything. They're what you expect from a truck. And they're what the name Jeep stands for! So, isn't it time you considered a truck built by Jeep? A truck that delivers all the rugged dependability that Jeep is famous for plus exceptional payload capacity, high ground clearance, low loading height and a roomy, comfortable cab. Jeep Truck has all of these and one thing more: Jeep 4-wheel drive that's built in, not added on, for unsurpassed traction. A truck that's built Jeep tough! Compare it to the competition; we think you will be very impressed!

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GREATER PAYLOAD CAPACITY THAN FORD, CHEVY AND DODGE More cubic feet than all three, too! Jeep Truck lets you haul more! And when you get down to it, isn't that what a truck is all about?



HIGHER GROUND CLEARANCE THAN CHEVY AND DODGE Sooner or later, you'll find yourself in a situation where a little extra ground clearance means the difference between getting hung up or easily driving away. Jeep Truck lets you clear rocks and obstacles easily.



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LOCKING HUBS AND AUTOMATIC TRANSMISSION FOR BETTER PERFORMANCE Locking hubs are standard for 1980, allowing you to disengage front wheels when 4-wheel drive is not needed—a good way to save wear and tear on the drive train. And now part-time 4-wheel drive is available with automatic transmission to give you top performance! Quadra-Trac, Jeep's exclusive, automatic 4-wheel drive system, is also available for unsurpassed traction.

A LOT OF TRUCK FOR THE MONEY The Jeep Truck has a lot going for it—including a very competitive price. So, come on in, check us out, go for a test drive. Isn't it time you considered more of a truck?!



FROM THE TRUCK DIVISION OF JEEP CORPORATION

IT'S NEW NOW

Build your own bulldozer

The Dahlico tractor can be purchased already assembled or as a kit. The tractor itself is just over 6 feet long and 49 inches wide, with a 16-hp engine. It has a four-speed transaxle, geared rubber tracks and optional four-wheel

drive. Over 30 attachments are available, including dozer blade, loader bucket and backhoe. The kit is \$3495, while a fully assembled unit is \$3798. From Dahlico Corp., Box 231, Cedarburg, Wis. 53012.



Set-up to go

The Perfect Set Up is a portable work center that folds into a 6x19½x36-inch steel case. The complete unit weighs 43 pounds and can be moved via rubber casters on the case. About \$100 from Kreitz Industries Inc., Box 60, Pequot Lakes, Minn. 56472.



Garden without soil

Makers of the soilless Hydrogarden claim its yield is 3 to 10 times that of soil gardens, with year-round growth, as well. Plants are supported by vermiculite, while a continuous bath of nutrients flows over the roots. The self-contained unit has a pump and nutrients. About \$45. B and C West, 350 Paul Ave., San Francisco, Calif. 94124.



APPLIANCE CLINIC

QUESTIONS ANSWERED

Case of the green slime

For the past several months, water has been collecting at the bottom of our Whirlpool No-Frost refrigerator/freezer, model ETT-14J. Should I call a serviceman? —John Rega, Painter, Va.

Only if you don't want to bother making a simple repair yourself. Pools are probably the result of slime buildup in the drain tube. The buildup occurs after a number of years of defrost water dripping through the tube. The slime blocks the tube, causing defrost water to overflow and leak down the wall of the unit to the floor.

To fix the problem, find the drain cup on the back wall of the refrigerator. Get a syringe that forms strong suction. A basting syringe or carbattery syringe is suitable. Using the syringe, suck water from the drain cup.

Then, mix a solution of hot water and baking soda. The solution should not be pasty, but should flow easily. Fill the syringe with solution and, using maximum pressure on the syringe ball, pump solution into the drain tube, which is attached to the drain cup. Do this about seven or eight times to clear the obstructed drain tube.

Brushing away trouble II

In "Brushing Away Trouble" (*Appliance Clinic*, page 28, June '79), we stated that a commutator should be dressed by rubbing lightly with emery cloth and that sandpaper shouldn't be used.

We received a number of replies telling us that sandpaper, not emery cloth, should be used. Emery is electrically conductive and can cause shorts.

Although we've spoken with several service technicians who prefer emery cloth because it does a better job, the official word from the *Electrician's Handbook* is to use fine sandpaper. It is most important that the commutator be left free of dust and grit, or else you will encounter a problem.

Hose job II

You suggested in *Appliance Clinic* that people turn off water faucets when their washing machines weren't in use (see "Hose Job," page 62, Mar. '79). As a former installer of washing machines it was my duty to

tell customers to shut off faucets after washing to take unnecessary pressure off hoses. You'd be surprised at how many people already knew firsthand the consequences of not taking this precaution—flooded basements.

I'm writing to confirm, as strongly as I can, what you said. Those hoses are like a weight lifter. He may be able to lift 400 pounds, but he can't hold it indefinitely. —Gordon R. Halvorsen, North Bellmore, N.Y.

Thanks for your support for us and those hoses.

In a spin over spin

When filled with clothes, our Sears portable washing machine won't spin. Wash and rinse cycles function perfectly, but when it comes to the spin cycle—nothing. If we remove all the clothes, the tub spins normally. What do you think is wrong? —R. Cale, Sharon, Pa.

Chances are that the face of the drive clutch is worn. The clutch can't grab firmly enough to make sufficient friction to spin the tub when it is loaded. It may well be time to replace the clutch.

However, there's a good chance the cause of the problem may also be a clutch that is out of adjustment or a bearing that is seizing. If you are handy, buy a service manual for your machine from a Sears Service Center. It explains how to find the trouble and repair it. Otherwise, the best course of action is to call a Sears serviceman.

Straight from the shoulder

We own a Maytag gas-operated clothes dryer (Model 740-C). At times, when clothes are drying, I notice a fairly strong gas odor from around the outside vent. When clothes are finished drying and I open the dryer door, a very strong gas odor prevails. There is never a gas odor when the machine isn't operating. All connections are tight. Your thoughts on where the odor is originating would be greatly appreciated. —Mrs. Benjamin Dickstein, Baltimore.

The problem could be serious, so stop using the dryer and call your local gas company or an authorized Maytag repairman. The burner valve may be sticking in the open position, allowing gas to leak. If so, the valve should be replaced before the

dryer is operated. Never take chances with natural gas. Whenever you notice a gas odor, no matter how slight and no matter what appliance is involved, get professional help—fast!

SERVICE TIPS

■ Since a full dirt bag in an electric broom can reduce the broom's efficiency, many broom users make it a habit to empty frequently the dirt cup below the bag. But you should also check inside the bag for dirt buildup on the sides. Buildup here can severely hamper airflow. Make it your practice to periodically spread newspapers on the floor, remove the cup and reach up inside the bag to remove any wads of dirt. Safety note: Be certain to disconnect the electric broom from the power before doing the cleaning.

■ Every clothes dryer has a lint screen. You should clean this screen after every drying cycle. If lint is allowed to build up, clothes won't be dried efficiently and may still be damp at the end of a drying cycle.

On some dryers the screens are well hidden.



Lint screen is located in the dryer door.

For example, the lint screens on some Speed Queen clothes dryers are found in the dryer doors (shown).

If you have difficulty finding the lint screen for your machine, it's a good idea to check your owner's manual. It will tell you where to find the screen and how you should go about cleaning it.

If you have a question about any appliance, send it to *Appliance Clinic*, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.

For the man who has everything. Something to control it with.

The BSR System X-10. The Controller.



JUST PLUG IT IN.

Just plug the system into any wall outlet. Wherever you choose. (No special wiring is needed.) And you can control up to sixteen lights and appliances just by pushing a couple of buttons.

As a matter of fact, the X-10 is so easy to operate, you can do it with your eyes shut. So, if the late show

is beginning to turn you off, you can turn it off without budging out of bed. And keep your eyes shut until morning.

Or, say you hear a mysterious noise from downstairs in the middle of the night. Just reach for your Controller and turn on every light in the house. That'll scare the daylight's out of an intruder.

Or even if you just want to dim your lights, you can do it with the Controller.

UNDER \$90.*

And get this. An X-10 Control System with enough modules to control lights and appliances at three different locations in the house, costs under \$90. So the man who has everything doesn't have to have a pot of money to own one.

BSR System X-10.



Everything's Under Control.



BSR X-10 CONTROL SYSTEM

The Controller

Rich Lights

from Viceroy



The rich low 'tar.'

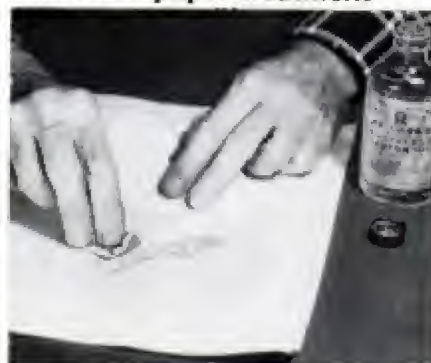
Kings and 100's.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

9 mg. "tar", 0.8 mg. nicotine
av. per cigarette by FTC method.

HINTS FROM READERS

Castor-oil paper treatment



You can make parchment or translucent tracing paper out of ordinary typing paper. Apply castor oil to the paper with a cotton wad or cloth and remove excess oil with cotton or tissue. If needed, thin oil with alcohol. Oil will be absorbed and won't rub off. Sketches and drawings on typing paper can be treated this way for duplication by photographic methods. Treated drawing used as paper negative can be reproduced by contact or projection printing.—*W. E. Burton*

Improving clothespin bite



You can give a hinged clothespin that is used for clamping a firmer bite by lining its jaws with strips of medium-grit sandpaper. Mount the sandpaper with contact cement.—*Aldo Brenner*

Cleaning an oilstone

To clean an oilstone covered with dirt and powdered grindings, soak it in kerosene and scrub with a stiff brush.—*Lane Olinghouse*

Litter-box scoop

The open-work, waffle-type meat trays from a market help rake and remove solid matter from a litter box.—*Helen LeMunyon*

PM LOOKS AT FLOOR SAFE



Flush with the floor and hidden under a rug, this safe helps promote peace of mind.

You can secure this steel safe in the floor, and then conceal it with a rug to make it both difficult to move and out of sight. The installation is fairly simple; it took me about an hour to complete.

First decide on a suitable location for the safe. A closet floor or a bedroom floor near a corner are both good choices. *Note:* it isn't advisable to install the safe between exposed joists where it could be spotted from a basement.

Locate nearby joists by boring a 1/4-in.-dia. hole and probing in it with a bent wire. After you have found a spot for the safe that's between joists, trace the outline of its base on the floor. Bore a 1-in.-dia. hole in each corner of the outline. Make the cutout using a sabre saw

with a coarse blade or a keyhole saw. Move from hole to hole to eliminate waste.

Test-fit the safe and trace the outline of the flanges onto the floor. Use a chisel or router to mortise a 1/4-in.-deep recess for the flanges. The safe top should rest flush with the floor.

Temporarily reposition the safe. Mark the placement of the Teenuts and screws which secure the unit to the floor. Bore holes and fasten the safe in place.

The floor safe is available at locksmith and hardware stores and is ticketed at \$100. For the retail source nearest you, write to: Deerfield Lock Co., 759 Hoffman Lane, Deerfield, Ill. 60015.—*Rosario Capotosto*



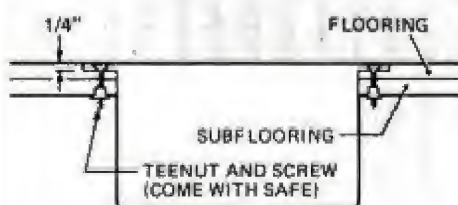
Locate the safe between joists. Then use a pencil to trace an outline for cutting.



Use a chisel or router to cut the 1/4-in.-deep mortise for the safe's flanges.

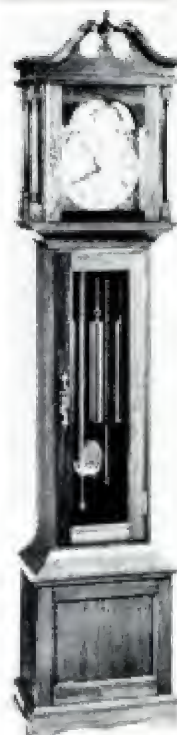


Bore a 1-in.-dia. hole at each corner of the tracing to coincide with the corner radii of the safe. Then use a sabre saw with a coarse blade to cut the opening.



Check that the safe flanges are flush with the floor. Then bore holes for Teenuts.

Build a Grandfather Clock Case for \$99.



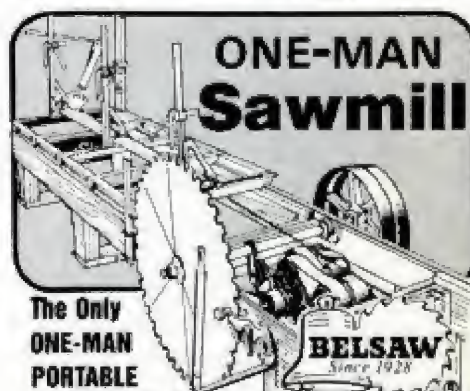
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Modern car speakers come in a great many shapes and types. Whatever design principles are used, good sound is their goal.

In the old days, a car speaker came with the radio—in some cases, they both were one unit—but not anymore. Now, you can get surface mounts or flush mounts to go on your rear deck, on the dash, in your doors, near your feet or a combination of these positions. Which one to choose?

The answer depends, of course, on your car and the amount of work and effort (or money) you're willing to expend. For instance, if your car comes equipped with rear-deck panel cutouts, it's easier and cheaper to install a set of speakers there than it might be to put them in the doors.

Conversely, if your rear panel is solid sheet steel, putting a set of speakers into it might be both difficult and costly. You might want to go to door, dashboard or kick-panel speakers—or to the enclosed surface-mount speakers, which can produce good sound. In fact, it was probably this last type that originally launched the move to more elaborate and better designed car stereo speakers.

Surface mounts

Audiophiles tried putting some of

Home on the road with today's great car speakers

Like all audio systems, the one in your car can sound only as good as the speakers. Choosing a pair depends on your car—and your pocketbook.

by Bill Kanner

the mini home speakers into their cars and got surprisingly good results. One of the first to be tried was the ADS 200 from Analog & Digital Systems. It's a two-way, acoustic suspension speaker. Originally intended for home use, where space is a problem, it produced solid bass response despite its diminutive size. At \$225 a pair, these speakers were not cheap, but auto-audiophiles gladly paid the money to get a whale

of a sound. They were so successful as car speakers that ADS now has swivel brackets available for the speakers at \$10 per pair.

But ADS was not alone in the mini-auto-speaker field. Soon it was joined by a host of others. Visonik and other companies had speakers similar in size to the ADS 200 and were actively promoting them for car use. The advantage of the con-

(Please turn to page 89)

FORD'S EXCLUSIVE CLUB ROOM



1980 Ford Captain's Club Wagon. All the luxury and comfort of a station wagon and much more room.

Here's one exclusive Club everyone can easily enter! Ford's advanced Club design means more move-around room for driver and plenty of inside passenger comfort. These Club Wagons are built tough—with separate body-on-frame construction, cushioned against bumps by rubber mounts. Plus—rugged Twin-I-Beam suspension. Wide engine choice: 4.9L (300 CID) 6-cylinder, 5.0L (302 CID), 5.8L (351 CID), 6.6L (400 CID), 7.5L (460 CID). See your Ford Dealer! Ask him about Ford's anti-corrosion warranty. And ask about Ford's Extended Service Plan.



Welcome inside the new Club. Ford's Captain's Club Wagon comes with fold-out card table, four swivel chairs, and seat/bed.



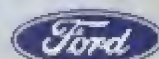
Combination seat/bed. Folding rear seat turns Ford's Captain's Club Wagon into a mini camper.



Super wagon size, too! Ford wagons offer seating plans for four to 15 passengers. And Ford Club Wagons offer light- and heavy-duty Trailer Towing Package options.

FORD

FORD DIVISION



THE SPARKOMATIC SOUND. CAR STEREO THAT GETS THE TRAVELIN' MAN UP WHEN THE LIFTS CLOSE DOWN.



The day is done—the last run a fading memory. But the fun isn't over, there's plenty après down the road.

On the road, Sparkomatic Car Stereo will keep your spirits high. And warm your ears with incredible high fidelity.

Traveling with our High Power series means getting there with the epitome in high fidelity specs. FM sensitivity, separation and noise reduction is equal to the highest home component standards. Distortion is indistinguishable. The overall sound efficiency overrides anything the competition offers—at any price.

Listening to Sparkomatic's SR 3300 High Power AM/FM Stereo with Auto Reverse Cassette is literally a touching experience. *Feather touch* electronic instrumentation expedites major high fidelity functions. Separate bass/treble and balance/fader controls discipline the sound for the most discriminating tastes.

45 watts of power makes this component-style stereo a spacious encounter in the space of your car. A set of Sparkomatic Speakers completes a sound system that reaches new heights in car high fidelity.

Get down to a Sparkomatic Dealer for a High Power Car Stereo demonstration.

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For our free catalogs on Car High Fidelity write:
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Sparkomatic Corporation, Milford, PA 18337

TODAY'S GREAT CAR SPEAKERS

(Continued from page 86)

verted home speaker approach is that they are easy to install. Just place them on the rear panel or other area and secure them.

Visonik's David (from David and Goliath) has impressive credentials

from the audiophile press and market. Putting it in a car is just a short step from having it in the den. The speaker itself is a small (6½ x 4½ x 4-inch), two-way design. Again, building solid bass strength into a small box is an expensive process. The David carries a price tag of \$230 per pair, with mounting brackets for



Pioneer has complete line of flush and surface mounts. These are its TS-X6 models.



MetroSound has these bi-amplified speakers, its MS-102 models. Text explains concept.



Crossover/control unit for these Jensen Series IIs shapes the acoustic environment.



Pioneer tune-up speakers are put where needed to offset highs lost in upholstery.

your car as an additional option.

The success of speakers like the ADS and Visonik has brought other companies into the field. Pioneer of America has a full line of flush-mounting speakers, but they also have two very interesting surface mounts as well—the TS-X6 and TS-X9. The X6 is a two-way system with a 4-inch woofer and 2½-inch high-frequency driver. The X9 uses a 3½-inch woofer with a 1-inch dome radiator. It has a crossover at 2800 Hz and a frequency range of 50 to 22,000 Hz, while carrying a list price tag of \$250 per pair. Canton also offers an at-home speaker for road use—their HC100. Other companies have similar offerings.

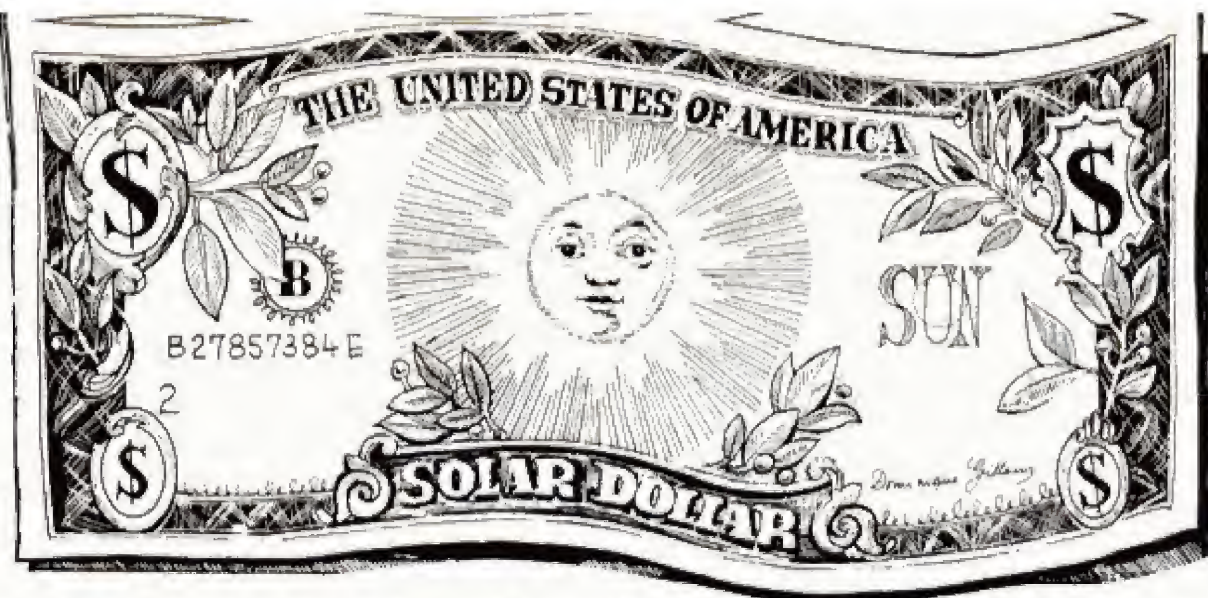
Another interesting surface-mount speaker design takes advantage of "bi-amping," which is having each driver in a speaker system powered by its own amp. A very sophisticated technique used in exotic home systems, it has recently been extended to cars. If your amplifier is a standard type, you leave a jumper wire connected. If you have a bi-amp, remove the jumper and connect the separate amp cables. Metro Sound's MS-102+2 is, like the others, a two-way, enclosed, acoustic-suspension design. The volume of air within the enclosure is not sufficient, however, to produce the thumping bass response many car stereo owners want.

So we're back to flush-mount, rear-panel speakers, which use the trunk space as an enclosure. If you imagine putting your car's trunk in your living room, you have some idea of how much air this approach utilizes to give "whomp" to the low end.

Flush mounts

Both car-stereo speaker companies and home/auto speaker makers have rethought and redesigned the conventional 6x9-inch flush-mount speaker. While once it was a very

(Please turn to page 176)



How to get dollars to go solar

It's a good bet that the National Solar Information Center (NSIC) can answer any question you have about solar energy. We asked the staff to answer the question foremost on the minds of many PM readers: Where can I get help to pay for a solar installation? They responded by preparing the state-by-state chart below (continued on page 194) and by explaining the current Federal tax credit.

Anyone who installs, or has installed, space heating, cooling or do-

mestic hot-water systems after April 20, 1977, is eligible for a Federal income tax credit of up to \$2200. On the first \$2000 you spend, you can take a credit of 30 percent; on the next \$8000, 20 percent. If, for example, you spent \$3000 on a domestic water-heating system, you would reduce your tax owed the government by \$800. In all states, excluding California and Montana, credit is available in addition to any state credit claimed.

In nearly every state you can get

some sort of tax credit against property, income or other taxes. Several states offer HUD grants of \$400 for purchase and installation of a domestic hot-water system. Details and applications are available from each state's energy office. Look up your state on the chart below.

For more information

The NSIC will answer questions about solar heating and cooling by phone, mail or in person. They main-

(Please turn to page 194)

STATES WHERE SOLAR DOLLARS ARE AVAILABLE

State	Property Tax Exemption	Income Tax Credit	Sales Tax Exemption	Grant Program	Loan Program
Alabama	No	None	No	None	None
Alaska	No	Up to \$200	No	None	None
Arizona	Yes	Up to \$1000	Yes	None	None
Arkansas	No	100% deduction	No	None	None
California	No	Up to \$3000; less if federal credit claimed	No	None	For veterans, homeowners in disaster areas
Colorado	Yes	100% deduction	No	None	None
Connecticut	Local option	None	Yes	HUD	For new and existing homes
Delaware	No	\$200	No	HUD	None
Florida	No	None	Yes	HUD	None
Georgia	Local option	None	Refund available	None	None
Hawaii	Yes	10%	No	None	None
Idaho	No	100%	No	None	None
Illinois	Yes	None	No	None	None
Indiana	Yes	None	No	None	None
Iowa	Yes	None	No	Low-income families	None
Kansas	Partial	Up to \$1000	No	None	None
Kentucky	No	None	No	None	None
Louisiana	Yes	None	No	None	None
Maine	Yes	None	Refund available	\$400 for hot-water systems	None
Maryland	Yes; credits at local option	None	No	HUD	None
Massachusetts	Yes	None	Yes	HUD	Increased ceiling on home improvement loans at credit unions, savings and loans
Michigan	Yes	Up to \$1700	Yes	None	None
Minnesota	Yes	Up to \$2000	No	None	None
Mississippi	No	None	Yes, for colleges and junior colleges	None	None
Missouri	Yes	None	No	None	None
Montana	No	Up to \$250; reduced if federal is claimed	No	None	Public utilities may make consumer loans
Nebraska	No	None	No	None	None
Nevada	Limited	None	No	None	None
New Hampshire	Local option	None	No	HUD	None
New Jersey	Yes	None	Yes	HUD	None

(Chart continues on page 194)



New Shell Fire & Ice[®] Motor Oil is as good to your gas tank as it is to your engine.

Shell Fire & Ice All Season Motor Oil protects your car's engine in blistering heat, shivering cold and everything in between. But that's not all.

Now, a special formula reduces engine friction so

well, it actually saves gasoline. As much, in comparable tests, as the leading gas-saving oils.

So change to Shell Fire & Ice 10W-40 Motor Oil.

It could save your engine. It will save gas.

©1987 Shell International Petroleum Corporation



Marlboro



Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

17mg "tar," 1.0mg nicotine av. per cigarette, FTC Report May '78



The most radical types of new aircraft design, such as this "nutcracker" idea from Grumman Aircraft, would cost millions to test-fly in "man-rated" prototypes. Instead, the company used a scale model flown by remote control to test swing-down tail concept for providing hovering capability with ducted propellers. Model cost \$10,000; nobody had to risk his neck.

Those amazing pilotless planes

Known as RPVs, remotely piloted vehicles can fly where angels, as well as men, fear to tread.

by William D. Siuru Jr.

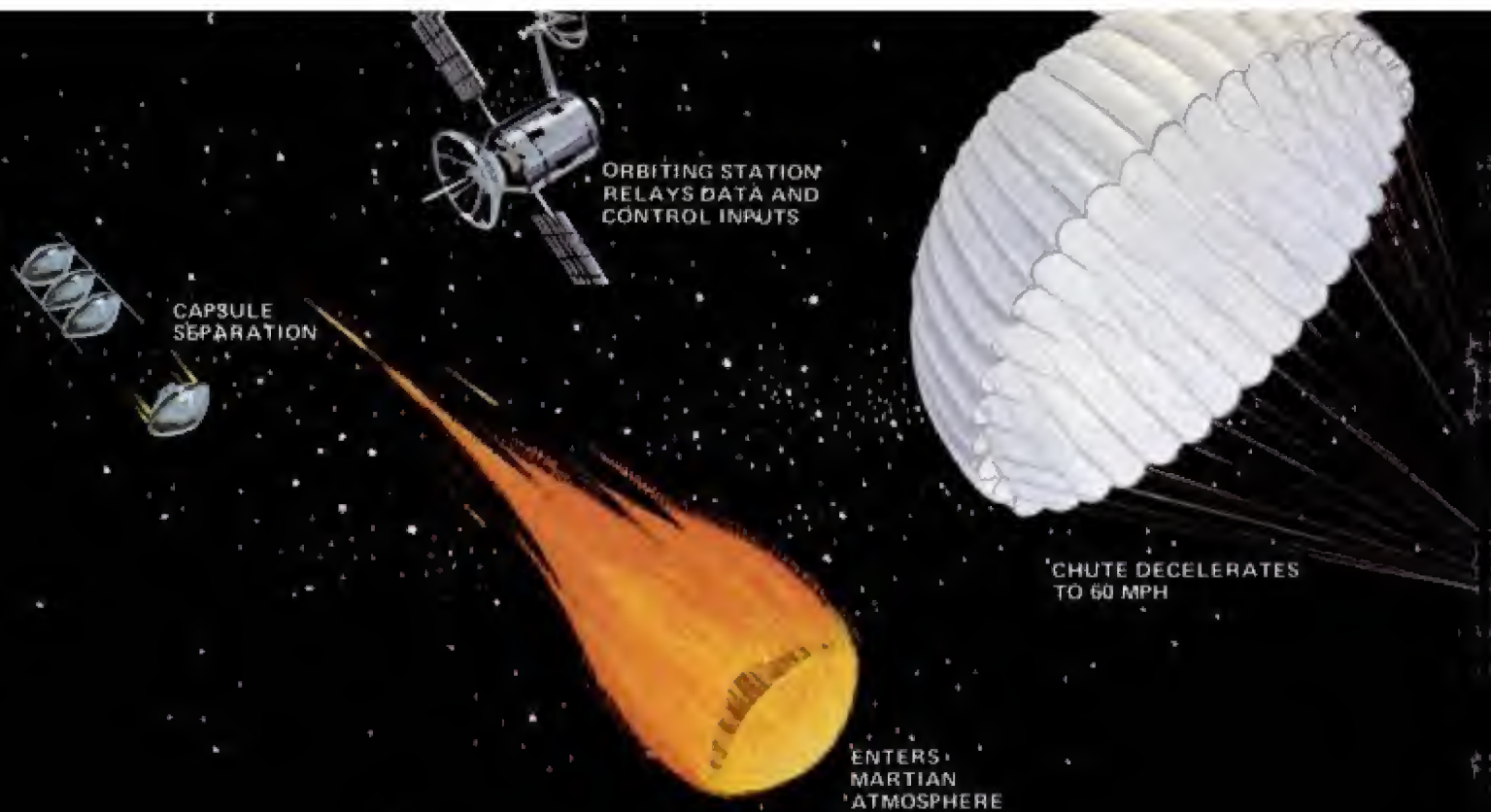
Recently, what may be the fighter plane of the future was released from a mother ship over Edwards Air Force Base, Calif., and powered away on its maiden flight—the first of many in which the radical, swept-wing canard design will test itself against the crushing G-loads of supersonic aerial combat that plane-to-plane encounters of the future will entail. A highly dangerous test regime? You bet—but don't worry about the pilot. He was safe on the ground "flying" the aircraft by remote control from a cockpit-like setup that includes a full instrument panel and a TV screen for a windshield.

Aerospace engineers have gotten into radio-con-

trolled models in a big way — only they have their own name for the craft: Remotely Piloted Research Vehicle, or RPRV for short. Everything from miniature versions of aircraft that can fly at supersonic speeds without a sonic boom being felt on the ground to models of that fighter of the 1990s have been flown or are being built.

In the past, if designers had an idea for a new aircraft and wanted to see if it would work, they either had to rely on calculations done by a computer and testing done in a wind tunnel, or had to build a full-scale prototype and fly it. The first approach almost never gives

(RPV illustration overlaid; text continues on page 96)



As conceived by Jet Propulsion Laboratory under a NASA research contract, an RPV could actually fly on Mars, even though at the surface the Martian atmosphere's density is only 1 percent that of Earth's. (Martian gravity is only three-eighths as strong as ours.)

As many as four of the aircraft, powered by hydrazine engines that do not breathe air, would be delivered by a spacecraft which would remain in orbit as a relay station. Entering the Mars atmosphere from orbit, the collapsed aircraft would be

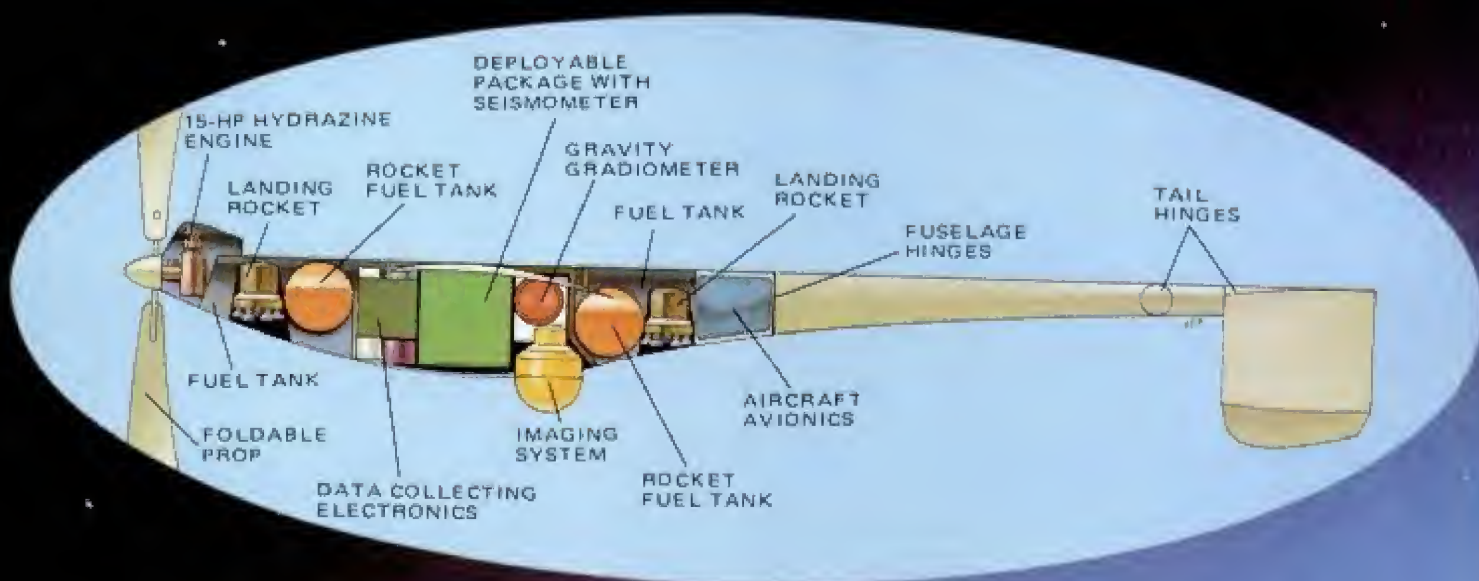
protected by Viking-type capsules; a parachute would slow the capsule to about 60 mph for capsule jettison, followed by unfolding and deployment of the aircraft into a vertical dive.

Pulling up at a preprogrammed rate, the aircraft would fly at speeds between 125 and 225 mph in "air" at the equivalent density of altitudes over 100,000 feet on Earth—although the flight regime on Mars would be carried out at much lower actual altitudes.

Two versions of the Mars airplane could

be built—one able to land and take off again with rocket engines, as shown below, the other a straightforward "cruiser" that could cover as much as 6000 miles in 30 flight hours before crashing. Navigational and terrain-following electronics would be preprogrammed for specific flight paths, since radio signals from Earth would take excessive time for total flight control.

Highly detailed pictures, atmospheric and geologic data would be relayed back to Earth.





CAPSULE
JETTISON

AIRPLANE
DEPLOYED



To test oblique wing flight concepts, NASA contracted for rotating-wing RPRV powered by 4-cylinder, 90-hp engine driving shrouded prop.



Stall characteristics of Air Force F-15 fighter were tested in a remotely piloted, 1/4-scale model of the plane, launched from a B-52.



Mini-RPV built by Westland Helicopters Ltd. in England could also be called a remotely powered helicopter (RPH). Designed to provide battlefield surveillance (both visual and electronic), the RPH uses a coaxial rotor system. Of prime interest to military users is its resistance to detection by radar, sonar or infrared equipment.

Developmental Sciences Inc., a California company which also worked on the Mars airplane with JPL (previous pages), has conceptualized and built several lighter-than-air RPVs in the form of miniblimps. Equipped with TV and infrared scanning devices, the aircraft could "orbit" high-crime areas, providing an unseen security system or covert surveillance by law enforcement agencies.



all the evidence necessary to convince everyone—especially pilots—that an aircraft concept is ready to fly. And building a prototype for the test pilot to put through its paces is extremely costly and time-consuming. The unmanned prototype can provide the needed answers quite inexpensively.

An RPRV can be built more economically because it does not have to be full-scale and does not have to be "man-rated." For instance, it need not have to have expensive life support and escape systems. The sophisticated electronics and flight controls can remain on the ground and simple, inexpensive systems can be used aboard the scale model. This also means the RPRV can be lighter and smaller.

Meanwhile, the complicated electronics and computers on the ground do not have to be miniaturized and designed to withstand the rigors of flight, resulting in substantial cost savings. Plus, in case of an accident, these expensive items will not be lost—not to mention pilots.

With RPRVs, the time between conception of an idea on the drawing board and actual flight-testing can be greatly reduced. Designers can see



Designed to test maneuverability of future fighter concepts, HiMat RPRV routinely pulls 6-G turns at supersonic speeds in test.



Air Force's Firebee II is a tactical RPRV system including models for high and low altitude reconnaissance plus ordnance delivery.

their ideas in flight sooner and aircraft companies can demonstrate new concepts to a customer to test his reaction in order to determine if it is worthwhile to pursue a project. Using RPRVs, problem areas can be pointed out before vast sums of money are invested, and some of the more risky ideas can be tried out without endangering the life of a test pilot. Finally, it is much easier to make and test modifications.

The simplest RPRV testing is done by carrying the model beneath a larger aircraft. Once a suitable altitude has been reached, the RPRV is dropped to make its test flight and then recovered by a parachute which is snagged by a helicopter. A more complicated approach is to land the aircraft by remote control. The ultimate RPRV is one that can both take off and land by remote control.

RPRV vs. drone

An RPRV is different from a drone. A drone normally has an autopilot that flies the craft most of the time. An RPRV is flown constantly by a pilot who is usually on the ground. Most research RPRVs use telemetry systems to monitor the flight and tell how the various parts of the aircraft are working. Typically, this includes such things as engine rpm, temperatures, altimeter, airspeed, bank and roll, angle of attack, sideslip and roll rate. For landings, a television camera in the RPRV gives the pilot on the ground the same view as if he were actually in the cockpit. Early RPRVs, however, did not have video displays, so the pilot had to land the aircraft from the ground while trying to keep it in sight just like R/C modelers do.

Stall and spin testing is one of the most dangerous and demanding requirements for a new design, but is nevertheless a necessary part of the verification of most new aircraft. When it came time to test the stall and post-stall characteristics of the Air Force's new F-15 Eagle, a 3/4-scale model of the fighter (photo on page 95) was used by NASA's Dryden Flight Research Center. This center at Edwards Air Force Base, Calif., has been the pioneer in building and using Remotely Piloted Research Vehicles. The 24-foot-long F-15 model was dropped from a B-52 bomber and then the ground-based pilot flew it through all the desired test maneuvers.

Another RPRV currently being used by NASA is the Firebee II. The BQM-34F, or Firebee, is a standard, high-performance, supersonic drone used by both the U.S. Navy and Air Force as a target for training combat pilots and for testing new weapons. Normally, the Firebee uses a built-in autopilot with only very general instructions being sent to it by a ground controller.

The way to test new ideas

NASA is modifying two Firebee IIs in order to test new aerodynamic concepts, including a flutter suppression device. It is very desirable to make aircraft wings as thin as possible to reduce weight and conserve energy. However, thin wings suffer from excessive bending at high speeds, or what is called flutter. NASA's device, located on the trailing edge of the wings, should damp out this flutter. The RPRV is a very economical way to see if these two new ideas are really as good as they

look on paper.

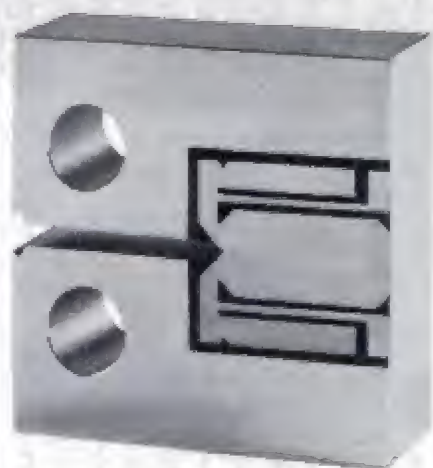
The Firebee is powered by a 1920-pound-thrust turbojet engine that allows the 2000-pound craft to fly at almost 1200 mph at 45,000 feet altitude. The Firebee RPRV will be dropped from a B-52 for its flight that can last up to an hour. If the pilot on the ground should lose radio contact with the Firebee, an autopilot will automatically fly it until a backup human pilot in a two-place F-104 chase plane can take over the controls. When the flight is over, a parachute will be popped to slow down the Firebee and eventually get it into a vertical attitude for retrieval by a helicopter. After the chopper has snatched the RPRV by its pilot chute, the main chute will be released and the helicopter would carry the drone safely to the ground.

Beating the sonic boom

NASA is also looking at various means for aircraft to fly faster more economically and without producing the objectionable sonic boom that has limited the use of the Concorde SST. One attractive approach is the scissor- (or oblique-) wing airplane. The scissor-wing would have a thin wing that requires less power on takeoffs, landings and while loitering near airports. For high-speed flight near Mach 1, the entire wing is pivoted up to 60°. This makes the wing "believe" it is flying at a lower speed where the drag is less, the fuel economy is better and no sonic boom is created. Because the concept of a pivoting wing is rather radical, a manned scissor-wing prototype was a rather risky and costly proposition as a first attempt. Therefore, an RPRV version

(Please turn to page 159)

Get cracking



Metal under stress can fatigue and crack at inopportune moments (as when an airplane is airborne). Fractomat, made by the Hartrun Corp. of Chaska, Minn., can give instant warning of the position and the size of a crack as small as .0004 inch, the maker claims. Heart of the unit is the Krak-Gage, a thin piece of specially shaped foil (shown above on a test specimen) that, when bonded to a metal part, cracks when the metal part cracks. Connected to an electronic circuit, its resistance changes in proportion to the size of the crack. With the appropriate instrumentation, the crack can be detected before it becomes dangerous.

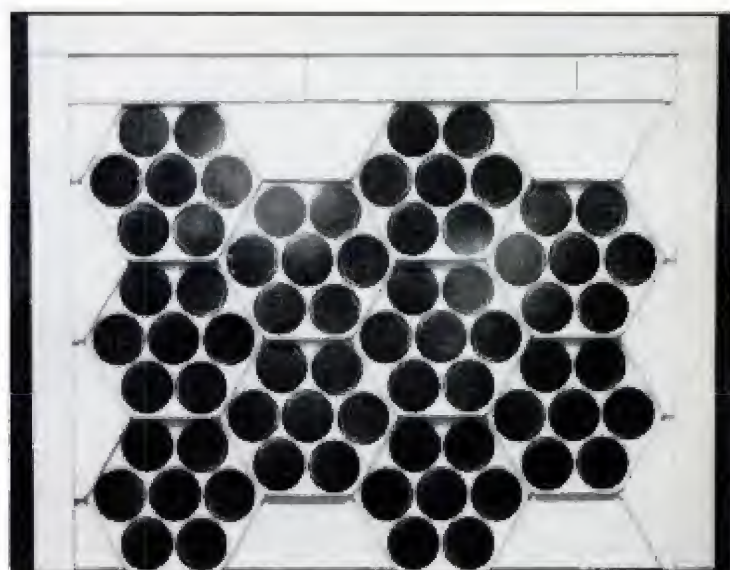
Wheat, did you say?



The ancient Egyptians used to line underground pits with reeds and fill them with grain. In an Australian update of that method, surplus wheat is stored between 8-foot-high earth embankments. Since a

rising water table could spoil the grain, the floor and sides of the storage are lined with plastic. After the wheat is poured in, it is covered with plastic, a layer of sand and one meter of earth.

Electric roof



These photovoltaic roof shingles won't drive your house too far, but they might take care of most of your electric bill. Made by General Electric, they use off-the-shelf solar cells and put out about 92

watts per square meter. Bonded to each rectangular synthetic rubber/foam shingle (left photo) is a hexagon of heat-tempered glass with the cells bonded underneath. Since so few have been built,

no meaningful price is available, but there is talk that the shingles could hit the market around 1985 if the price can be brought down near the Department of Energy's target of a dollar a watt.



Toshiba setup (shown full size) typifies sparkling appearance offered by these new minis. Performance is like the big guys—40-watts-per-channel, along with quartz-synthesized FM tuning and subsonic filters.

New ministereos sound like giants!

They've always said that good things come in small packages—now the hi-fi companies are trying to prove it! Their new minis take up less space than full-size units, but have full-size performance specs.

by Hans Fantel



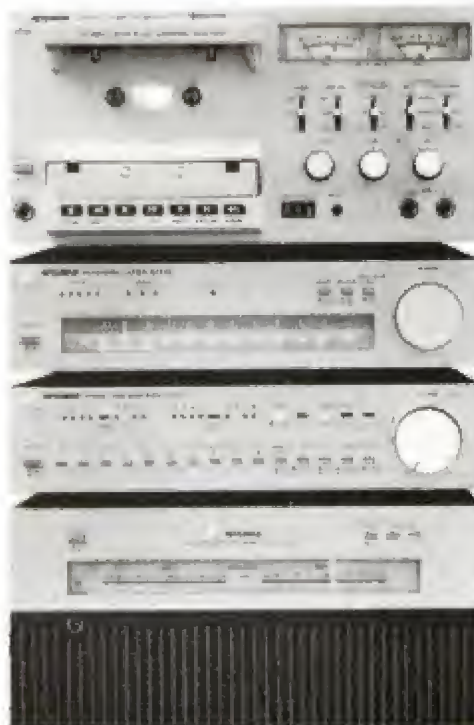
To put first-rate stereo sound into your home once meant cramming your living room with massive components. And if you happened to live in small quarters—a city apartment or a college dorm—the problem was where to stash all that equipment.

That problem has now been solved with the latest in audio designs, the so-called mini-components—tuners, amplifiers, receivers and tape decks—scaled down to the size of a cigar box. Typically, they're less than a foot wide and, in some cases, only 2 inches high. They look like toys—sound equipment for a doll house—tiny and delicate. You'd expect them to tinkle.

But turn them on and you won't believe your ears. These bantams put out big, honest sound. Only their size has shrunk—not their performance. Anything from rock to symphonies comes across convincingly, with nothing missing anywhere in the total sound spectrum. What's more, even at full volume the sound stays crisp and clear, for the new minis manage to keep the same low distortion specs as their bigger brothers. To sum it up, they are the first kind of quality sound equipment that actually fits on a bookshelf.

How, you ask, could it be done? First thing was to let out the air. Many regular components are lots bigger than they need to be. In fact, they're bloated. Look under the

(Please turn to page 151)

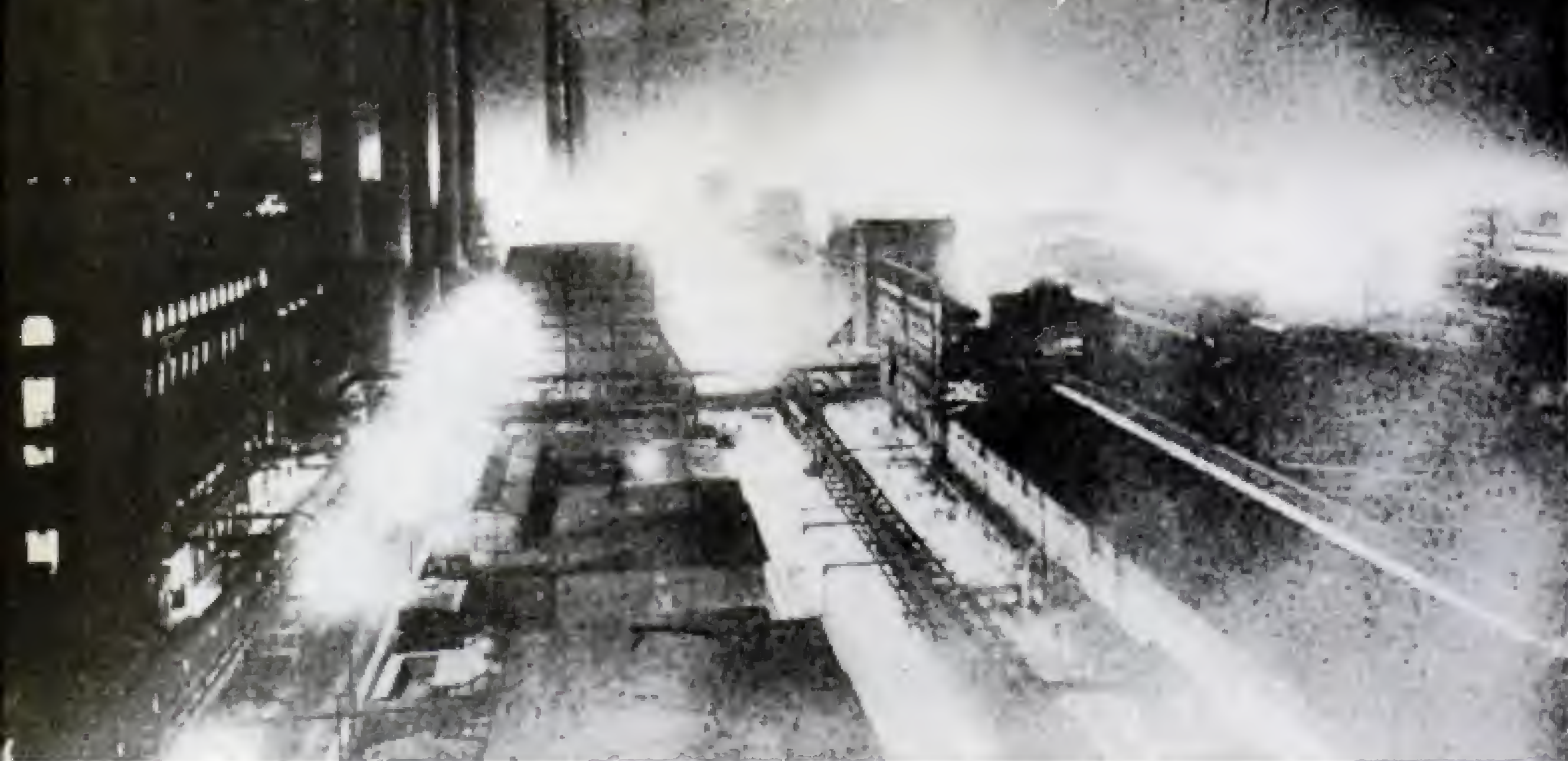


Radio Shack's STA-7 (above) is the lowest priced unit we saw. It offers very good value for the cost-conscious minishopper. Mitsubishi (left) offers a complete set, including a cassette deck, only 10 inches high. Power is a giant 70 watts per channel and it has such things as pushbutton controls and LED power indicators.



Two Sony units (above) are a stereo tuner atop an integrated amplifier combining amplifier and preamplifier into one neat package. It's rated at 50 watts per channel. The Technics set (left) has 40 watts per channel with high and low filters, balance and loudness controls and special LED power output indicators for a miniature light show.

Fuel for the Führer



During WW II, the synthetic-fuel production went on night and day until bombed out. All photos on these pages are of Leuna plant.

We may yet get valuable tips from captured documents that show how Germany ran on synthetic fuel during the war.

by Mort Schultz

In 1944, General George S. Patton's Third Army, steamrolling across southern France, came to an abrupt halt. In his haste to be the first U.S. commander to cross into Germany, Patton had overextended his supply lines.

Tanks, armored personnel carriers, trucks and staff cars, out of gasoline, couldn't be resupplied immediately. As a result, Patton had the choice of staying put until the supply train caught up, or of draining captured German vehicles and using so-called *ersatz* (synthetic) gasoline to run his armored columns.

Ersatz gas it was, then, and it wasn't bad stuff . . . not bad at all.

As a matter of fact, if it weren't for ersatz gas, which we call "synfuel" today, Germany would have been defeated long before 1945. There are some scholars who even believe that lacking a synthetic-fuel industry, which gave his army and air force gasoline made from coal, Hitler never could have started World War II.

As the United States begins the multibillion-dollar synthetic-fuel program announced by President Carter in July, the experience of Nazi Germany's synthetic liquid-fuel industry can play a vital role in America's future.

Studying captured documents

At the Center of Energy and Mineral Resources of Texas A&M University in College Station, Tex., there is a mass of information on the German synfuel industry from its inception at Ludwigshafen/Oppau in the mid-1920s.

It was at Texas A&M that I met with Dr. Kurt J. Irgolic and learned the startling facts of the Nazi coal-conversion industry. Dr. Irgolic, who is associate director of the Center for Energy and Mineral Re-

sources and a professor of chemistry, is also principal investigator of the German Document Retrieval Project, as the program is called.

As the Allied armies overran Germany in 1945, thousands of documents describing the establishment and successful operation of the nation's coal-liquefaction plants were captured. Liquefaction refers to changing the molecular structure of coal, converting it into liquid fuel.

Documents told in precise detail how a nation that lacked natural petroleum resources managed to make itself energy independent by using its vast coal reserves.

Documents were brought to the United States and Great Britain and were stored in various depositories where they remained, untranslated, until 1975. In that year, with

Views of Leuna synfuel plant and other facilities are now being studied at Texas A&M.



the shock of the Arab oil embargo of 1973-74 still fresh, a team from Texas A&M began searching for and collecting copies of the German documents.

In total, 500,000 pages of documents dealing primarily with coal conversion techniques were brought back to Texas for translation, summation and indexing. These are not all the documents the Germans prepared; there are more to be retrieved. Furthermore, only 10 percent of the 500,000 pages that are on hand have thus far been studied.

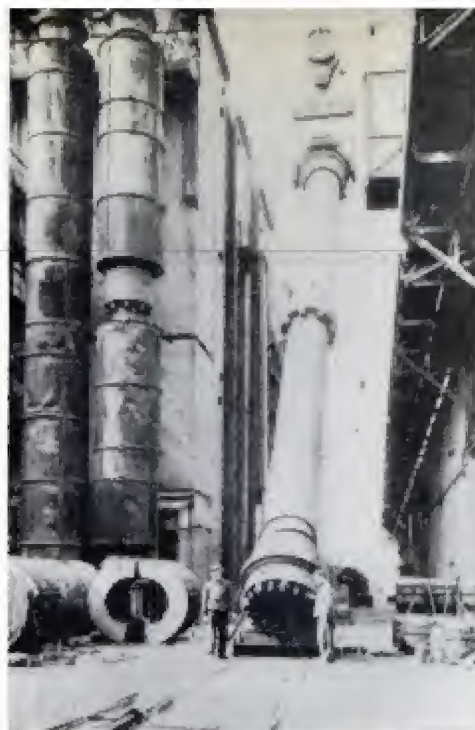
Blueprint to fight energy crisis

Notwithstanding the comparatively small amount of translation that has been done, the documents that have been translated tell a remarkable story of motivation toward energy self-sufficiency. But as interesting as the story is, the documents are extraordinarily valuable for a more important reason: they give the United States a blueprint that can help accelerate development of our nation's coal-conversion process.

W.D. Gill claims that the problem that faced Germany and the one facing the United States are similar. Gill, along with Dr. Irgolic and Dr. W.E. Clark, is working on the German documents.

"The necessity for the Germans to develop synthetic fuels was an economic step similar to one currently facing the U.S.," Gill says. "Since the Germans had little natural petroleum of their own, oil had to be imported for their industry and economy to continue to develop."

Before Hitler came to power in



Coal liquefaction takes place inside reactor unit, shown here being assembled.

1932, the government of the Weimar Republic was concerned about the amount of money Germany was paying for oil. Hoping to stem the outflow of cash, the government asked industry to speed up experimentation that would demonstrate how Germany's vast coal resources could be converted into liquid fuel.

Coal liquefaction had first been achieved in 1912 by Friedrich Bergius, a German chemist. The process earned Bergius a Nobel Prize in 1931.

The first step in the Bergius process is to grind coal and mix it with heavy natural or synthetic oil. This



This is the bank of reactors for treating coal to get quantities of synthetic crude oil.

coal-oil mixture is called a slurry.

The heavy synthetic oil is made as a byproduct during the liquefaction of coal. As the war progressed and natural oil became almost nonexistent in Germany, "synoil" was used exclusively in making the slurry.

The next step in the Bergius process is to push the slurry from vats into reactors. The vats are actually pumps called paste presses.

Coal liquefaction takes place inside the reactors. The process depends, in part, on a catalyst to transform the molecular structure of coal. The Germans used molybdenum and tungsten sulfide. Hydrogen is introduced into the reactors to convert coal to liquid-fuel hydrocarbons.

Temperature of about 400° C. and pressure of 6000 to 7000 pounds per square inch are applied. The combination of hydrogen, pressure and temperature breaks down the coal into a liquid. What leaves the reactors, then, is synthetic "crude" oil.

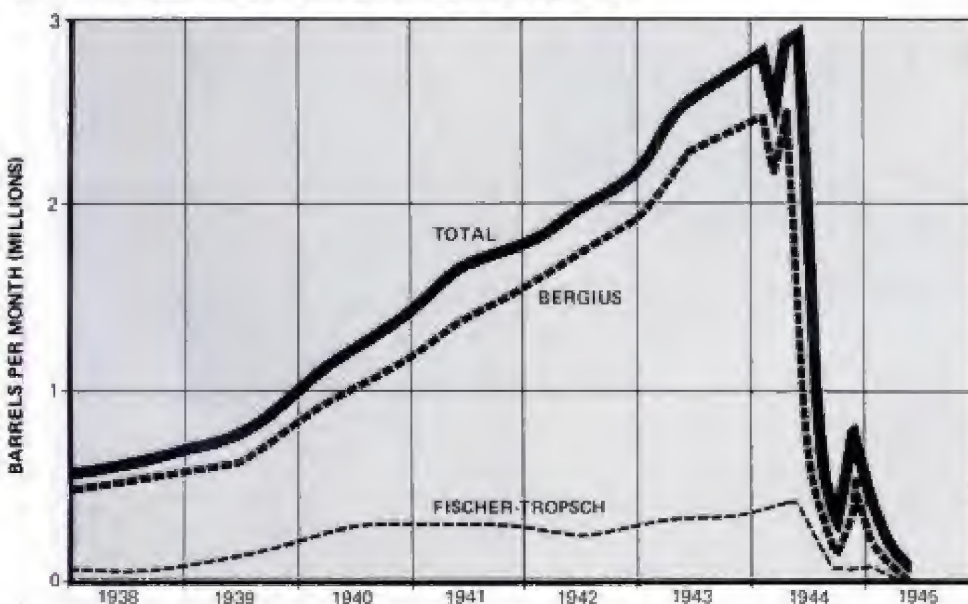
Refining process similar

To make the "syncrude" ready for use in motor vehicles requires a process that is not unlike the refining of natural crude oil. A distillation process removes the more volatile components of the syncrude.

The vapor resulting from distillation is reacted with hydrogen to become the liquid fuel. This "synfuel," like gasoline derived from natural petroleum, undergoes a blending process to raise its octane to meet the needs of motor-vehicle or aircraft engines.

Between 1920 and 1930, an alternate method of producing liquid fuel

Production of synthetic fuel increased slowly in the '30s, but then showed a marked rise at the start of WW II. A peak production of nearly 3 million barrels per month was reached in 1944 before plants were captured or destroyed by Allies.



GERMAN SYNTHETIC FUEL PRODUCTION DURING WW II

(Please turn to page 162)

IT'S NEW NOW

Hotel in your pocket

The Pocket Hotel is a one-person tent that weighs only two pounds and sets up quickly, according to the maker. It measures $4\frac{1}{4} \times 15\frac{3}{4}$ inches when packed; it's $7\frac{1}{4} \times 2 \times 3$

feet when pitched. Made of Gore-Tex, it is waterproof and needs no rainfly. About \$100 from Early Winters, 110 Prefontaine Place S., Seattle, Wash. 98104.



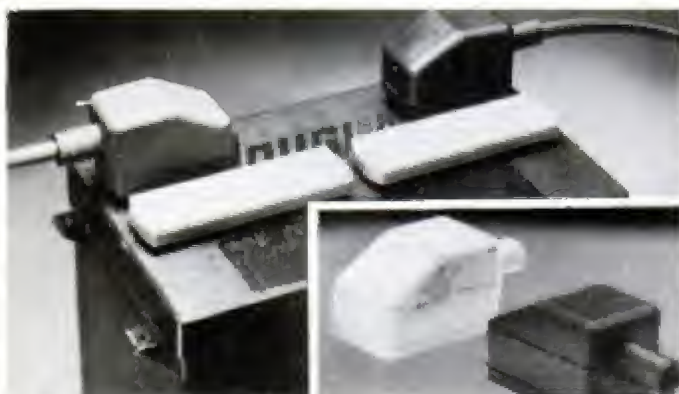
Trim with a fin

The Doel Fin stabilizes boats like a trim tab, but is less expensive and quicker to install, maker claims. Made of polypropylene, it attaches to cavitation plate of an outboard motor or stern drive. It's about \$40 from Doelcher Products, Inc., Box 5215, Mission Hills, Calif. 91345.



Terminal protector

Battery Terminal Covers keep terminals clean, reduce corrosion and prevent shorts, maker claims. Made of neoprene rubber, they slip on over battery clamps. A set (one black, one red) costs \$3. Moeller Manufacturing Co. Inc., Box 1318, Greenville, Miss. 38701.



If you're near Three Mile Island

Detector is a battery-powered home radiation detector with digital readout. Powered by a 9-volt battery, it is designed for checking for radiation leaks in microwave ovens and other appliances. It can also be used to detect nuclear contamination of food. About \$70 from Micro-Ray Inc., 2 Penn Plaza, Suite 1500, New York, N.Y. 10001.



Net gain

The Helmsman flotation vest features a polyester net back for greater comfort and freedom of movement. It also has 12 layers of foam in the front, which the maker claims are more adaptable and more comfortable than other foams. Coast Guard listed, it's about \$20 from Sears, Roebuck and Co.

FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR



Driving the 1980 Toyotas and Datsuns

The Toyotas

Notice how Toyota's been re-vamping its cars—one line at a time—these past three years?

First came the rebodied Celica for 1978, then the 1979 Corona, and now



Toyota Corolla liftback (above), like all '80 models with Corolla nameplate, is longer by a couple inches. New model, the Tercel, is Toyota's first front-wheel-drive car. Hatchback version (above right) and notchback sedan (right) are built on a 98-inch wheelbase and are 160.1 inches overall.

there's the crisper, bigger Corolla, plus a brand-new 1980 Corolla sub-species called the Tercel.

The Tercel (rhymes with *rehearsal*) represents Toyota's first plunge into front-wheel drive. It shares no mechanical components with any other Toyota import, and although it's classed as a Corolla spinoff, it's really a totally separate, independent line.

The Tercel was conceived and designed by one of Toyota's top engineers, managing director Tatsuo Hasegawa. Hasegawa hasn't chosen to follow the common practice of setting the engine crosswise. Instead, the Tercel's single-overhead-cam, 1452-cc Four runs the long way, with the gearbox below and behind the engine and the differential just under the No. 4 cylinder.



This tends to make the engine compartment slightly longer than in most sidewinders like the Rabbit, Honda, Fiesta, Strada, GM X-Cars and others. But with the Tercel's engine engineered specifically for shortness (21.6 inches stem to stern), plus the car's relatively long 98.4-inch wheelbase, there's no power-unit intrusion into the passenger area.

Advantages of the Tercel's engine placement include easier repair access and longer axle shafts. Front-wheel-drive cars with east/west engines usually have very short, unequal-length half-shafts. The Tercel's

longer shafts give more ride travel with far less camber change.

The disadvantages of Hasegawa's system, though, are a slight increase in the car's overall length (the Tercel is five inches longer than the VW Rabbit, despite being 77 pounds lighter), a higher center of gravity and a slightly taller hoodline.

Inside, the Tercel still has a fair-sized central tunnel. From the standpoint of passenger packaging, this car might just as well have a drive-shaft under the floor. Where the Tercel picks up space, though, is in its trunk. The trunk is quite large,

TOYOTAS *continued*

with a flat floor and a low lift-over-sill.

The Tercel's suspension is by MacPherson struts up front, trailing arms on coil springs aft, with stabilizer bars at both ends. All suspension-to-body attachments are

heavily bushed in rubber, and the car is very quiet, even on rough roads.

Driving the Tercel

I got a chance to try out the Tercel and other 1980 Toyotas at Laguna Seca raceway. The Tercel feels like a much larger car in terms of ride, silence, spaciousness and seat-to-

wheel positioning. The seats slide far back, and reclining backrests add even more roominess for front-seat riders. There's ample space, too, in the rear, especially with the front seat adjusted slightly forward.

When pressed hard around sharp corners, the Tercel understeers, as

(Please turn to page 146)

FIRSTHAND REPORT

by Gary Witzenburg

DETROIT AUTO EDITOR



The Datsuns

While the Detroit manufacturers are spending millions to downsize virtually every line of domestic cars, some import makers are busy "upsizing" certain models to increase their appeal and their competitive positions. This is the case with Datsun's all-new 200-SX sport coupe, which has been completely redesigned and re-engineered for 1980 to compete more effectively with Toyota's very popular Celica.

The original 200-SX, based on Dat-

sun's econobox B-210 chassis and introduced some three years ago, has been less than effective in dealing with the sexy new Celica that Toyota unveiled a short time later. Full-length side stripes helped its outdated, tank-like styling somewhat, but a cramped interior, harsh ride, barely adequate handling and an annoying five-speed gearshift pattern (back for first gear) didn't do much for its driving appeal. In the first seven months of 1979, for instance, Celica outsold the original 200-SX almost six to one.

Something had to be done, and now it has been. The new 200-SX, available in both notchback and sleek

hatchback body styles, is as contemporary and handsome as the old one was dated and homely. Both ride and handling are much improved, the interior is both attractive and roomy (at least in the front seat), the instrument panel is a masterwork of form and function, and the standard five-speed's shift pattern is everyone's favorite "double-H," with first up front—where it



Pop-top Datsun 280-ZX is closest the car will come to being a convertible. The T-roof panels, a new option for '80, stow in back.

All-new Datsun 200-SX comes in sleek, hatchback body style (left) and notchback. Power in both is 1-i., 2-liter Four.

Datsun King Cab gets 2+2 option with two inward-facing seats in back.

ought to be—and fifth above reverse on the far right. Even the radio (four-speaker stereo with the Sports Luxury package) has its on/off volume control on the left and tuning knob on the right, instead of the reverse arrangement found on most Japanese cars.

The first thing we noticed



RM photos: Bob Berger



upper right, a simplified version of the one introduced on the 280-ZX sports car a year ago, ticks off battery, washer-water and fuel-level checks. We snick the transmis-

gears, but then gives some resistance going into the overdrive fifth gear. There's a bit of engine and drive train noise, but the car is surprisingly free of wind noise at speed. The fingertip stalks for wiper/washer and lights and the levers for hood, rear-deck and fuel-filler releases are easy to locate and reach. Seating comfort, particularly important in smaller cars, is enhanced by the SL's eight-way adjustable driver's seat. Fore/aft location, seat-back angle, lumbar (lower back) and even thigh support can be dialed in to individual tastes. (Why, oh why can't the domestics pay even half this much attention to seats when most imports do such a tremendous job of it?)



Datsun 510 model lineup adds a five-door hatchback for the 1980 model year.

sion into first, and we're ready to go.

Moving away from a dead stop, we were unimpressed with the 100-hp engine's performance (it was brand new, not broken in), but it seemed zippier once underway. The transmission cuts easily through the four

in settling into our five-speed Sports Luxury (SL) notchback advanced test car was its excellent leg and arm room, even for long-limbed drivers—a rarity in small cars these days, particularly the Japanese variety. We fastened the comfortable seat-belt/harness system, started the new fuel-injected 2.0-liter four-cylinder engine with the first crank, and watched the big, round, easy-to-read dials spring to life. The standard full complement of instruments included (left to right) battery voltage, tachometer, fuel and temperature, speedometer/odometer and oil pressure. A useful and interesting graphic warning system (SL only) on the

Visibility from the cockpit is much better than the previous artillery-bunker design, interior ventilation is good, and airconditioning efficiency seems excellent, with plenty of outlets (including side window defoggers) to cool (or heat) both front and rear occupants. The rear side windows even roll down. Heater/AC

(Please turn to page 148)

MACHINES THAT

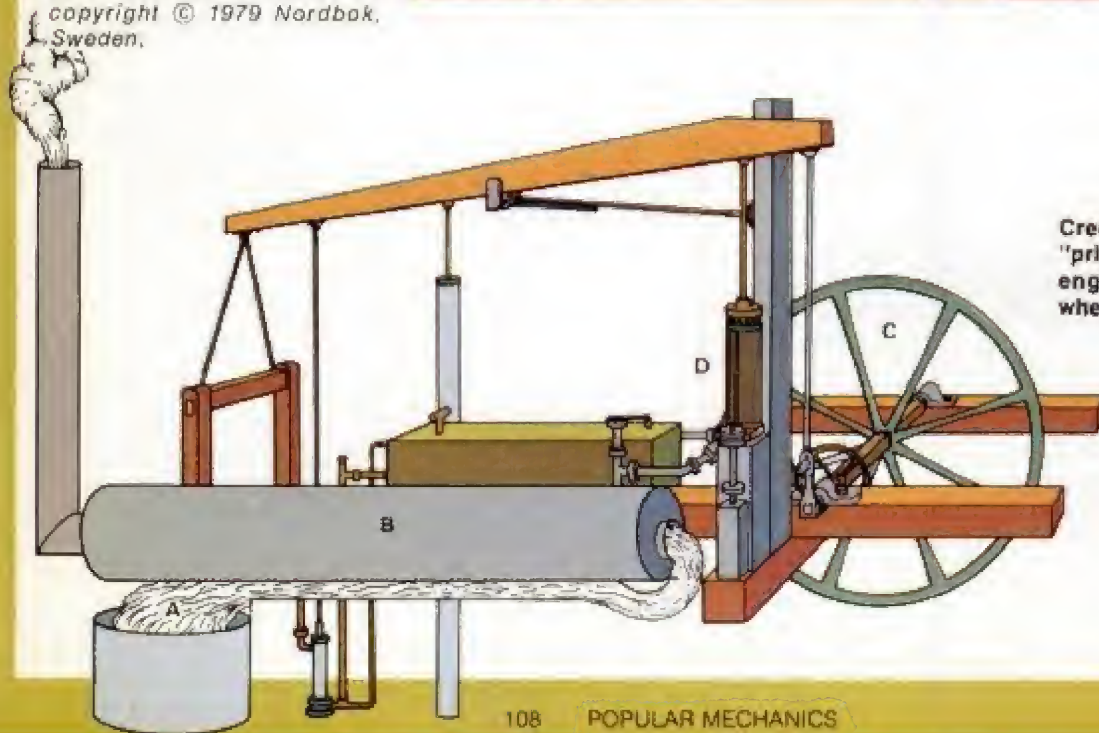
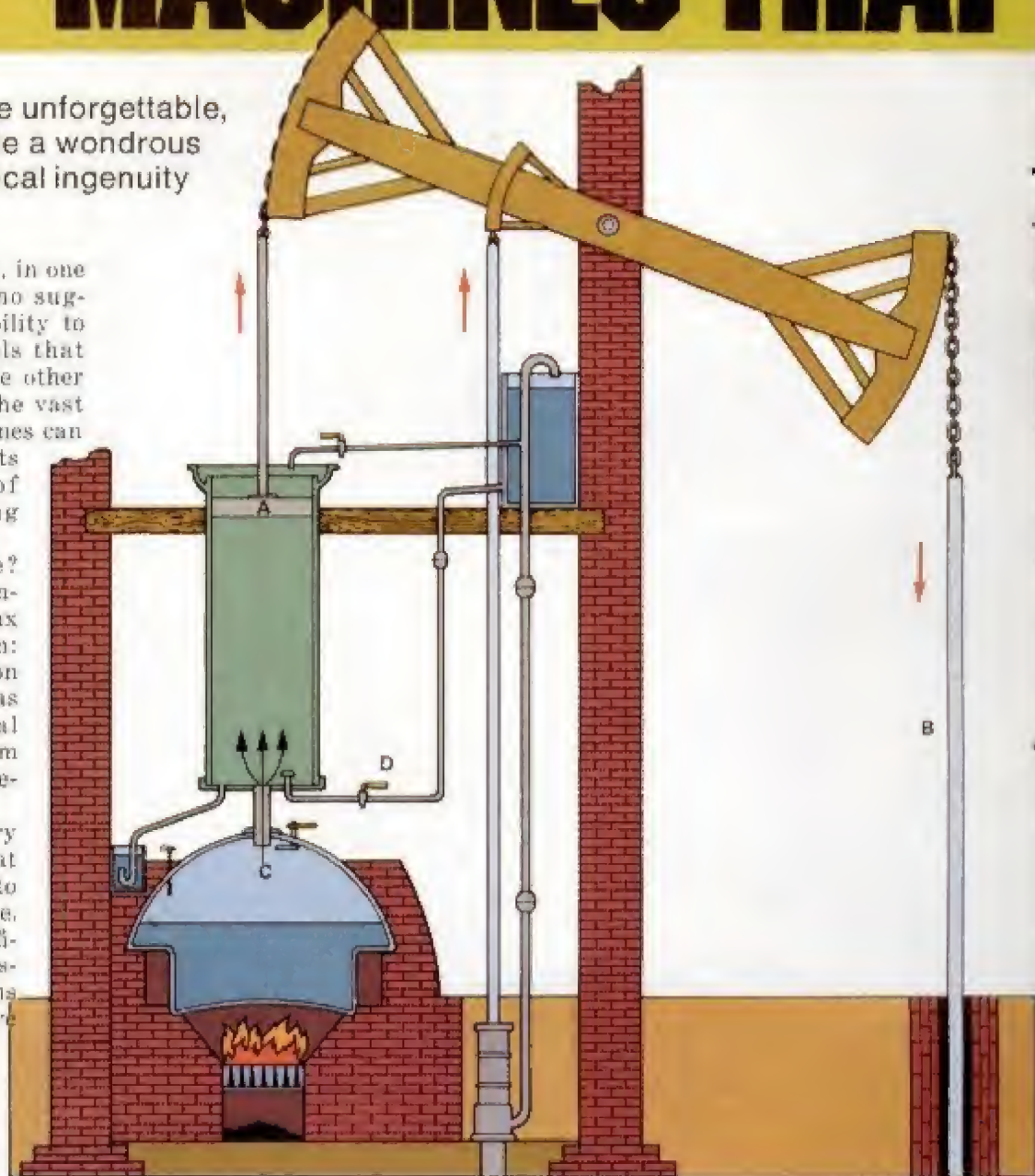
Some forgotten, some unforgettable, man's devices provide a wondrous record of his mechanical ingenuity over the centuries.

It was Benjamin Franklin, in one of his many essays, who suggested that it is man's ability to manufacture and use tools that distinguishes him from the other animals. The origins of the vast multitude of today's machines can be found in the implements fashioned in the dawn of history by our toolmaking ancestors.

What, then, is a machine? A century ago, a German engineer named Franz Reuleaux attempted a classic definition: "A machine is a combination of solid bodies, so arranged as to compel the mechanical forces of nature to perform work as a result of certain determinative movements."

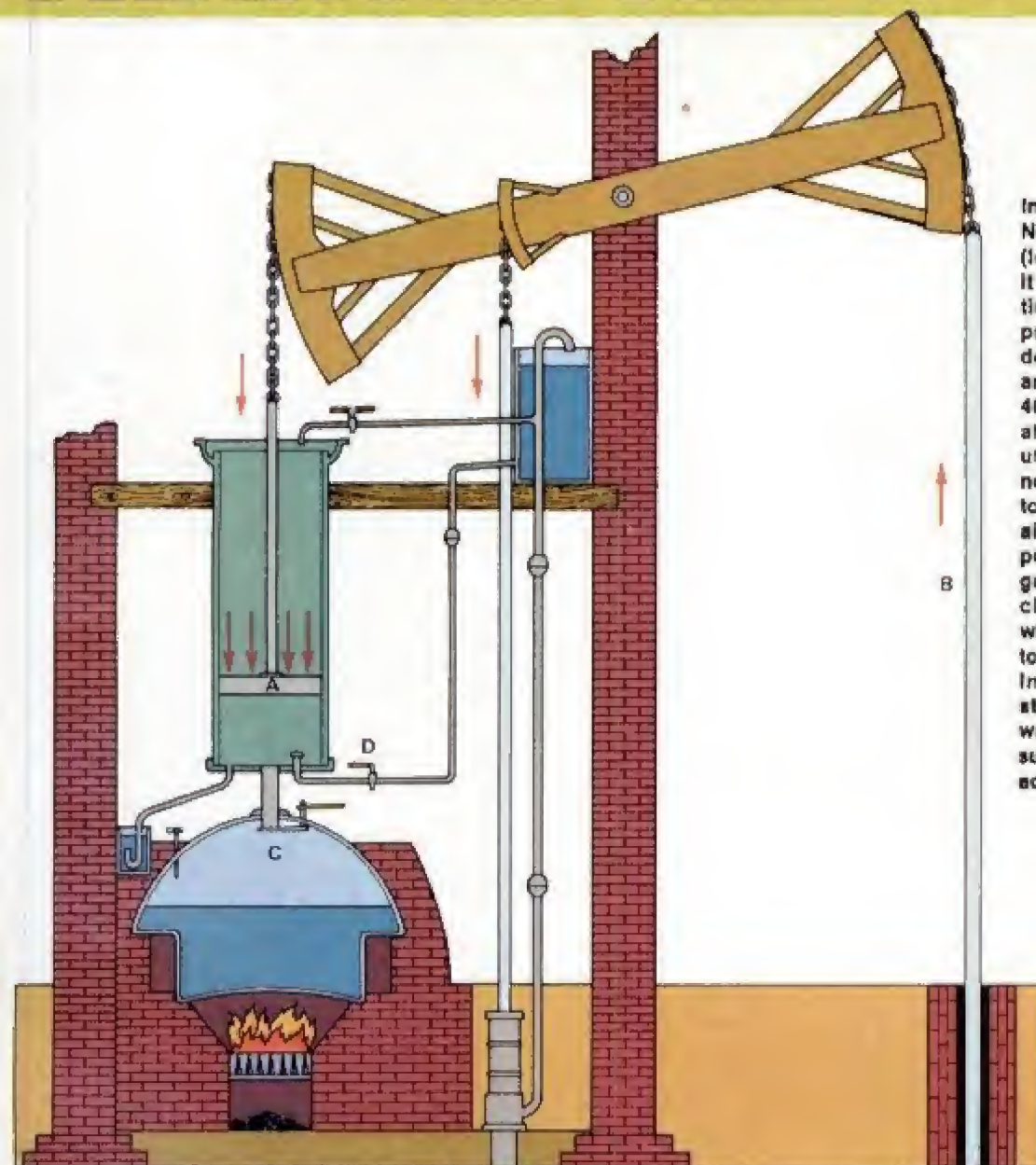
It is a subtle and still very controversial definition that does not lend much clarity to the concept of a machine. It is perhaps better to set definitions aside and try to illustrate in more concrete terms just what man's machines are and what they wrought.

Excerpted from the book, A History of the Machine, by Sigvard Strand, to be published by A & W Publishers, Inc. World copyright © 1979 Nordbok, Sweden.



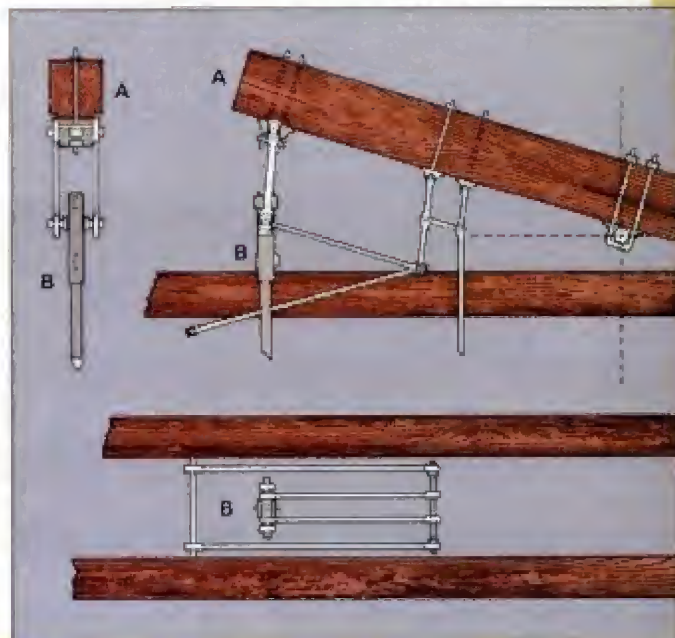
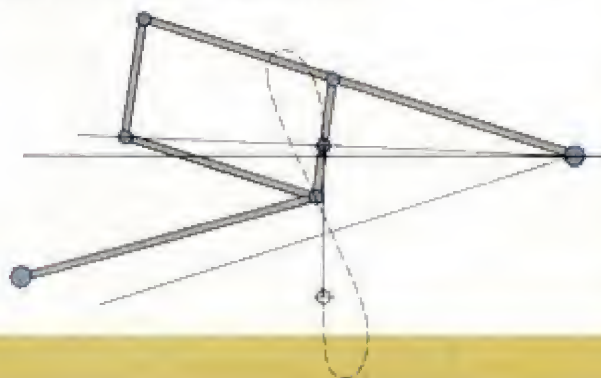
Credit for building the first movable "prime mover" goes to American engineer Oliver Evans. In 1804, when there were only six steam engines in the U.S., Evans completed this apparatus in which hot furnace gases (A) pass around a boiler's (B) outside and then inside before exhausting through a stack. The horizontal boiler's three-way cock was driven by a balance wheel (C), and led steam to a vertical power cylinder (D).

CHANGED THE WORLD



In 1712, Englishman Thomas Newcomen built this apparatus (left, facing page) and called it a "steam engine"—the first time that phrase appeared in print. It is estimated to have developed about 5 horsepower and pumped a little less than 40 gallons of water per stroke at a rate of 12 strokes per minute. Steam pressure, which was not very great, forced the piston (A) up inside the cylinder, aided by the weight of the pump rod (B). Power stroke began when one tap (C) was closed, shutting off steam, while another (D) was opened to spray cold water into the cylinder. This condensed the steam into a small amount of water, and external air pressure forced the piston down, accomplishing the work.

James Watt's steam engine had a balance beam, the outer end of which (A) would move in a curve, while it was desirable to have the piston rod (B) move vertically in a straight line. By using two jointed levers to "steer" the piston rod, Watt invented a parallelogram methodology which anticipated the tie-rod (Ackermann steering) system of the modern automobile.

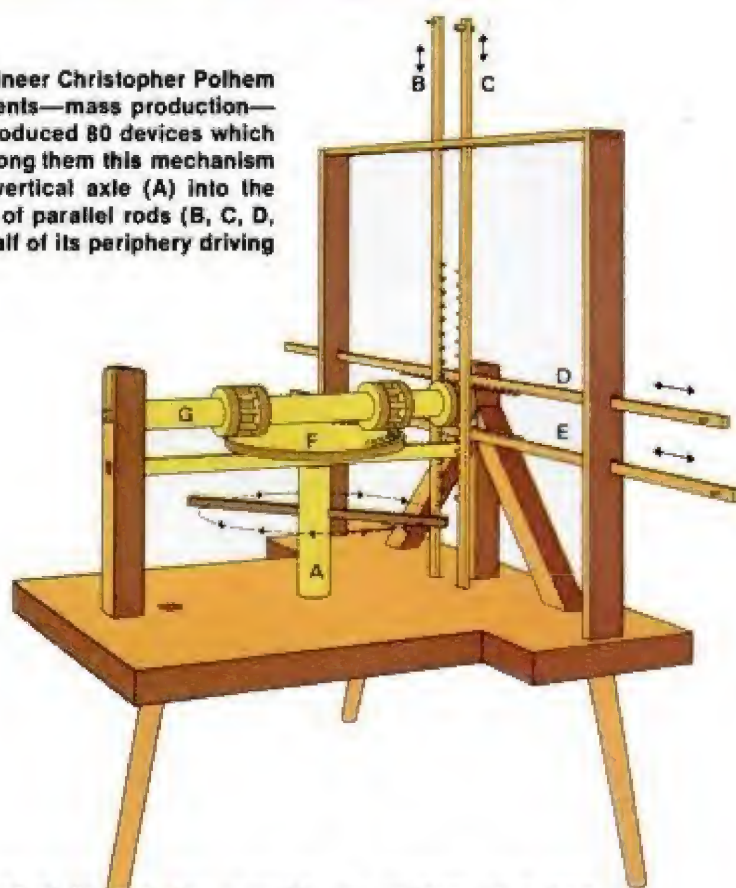




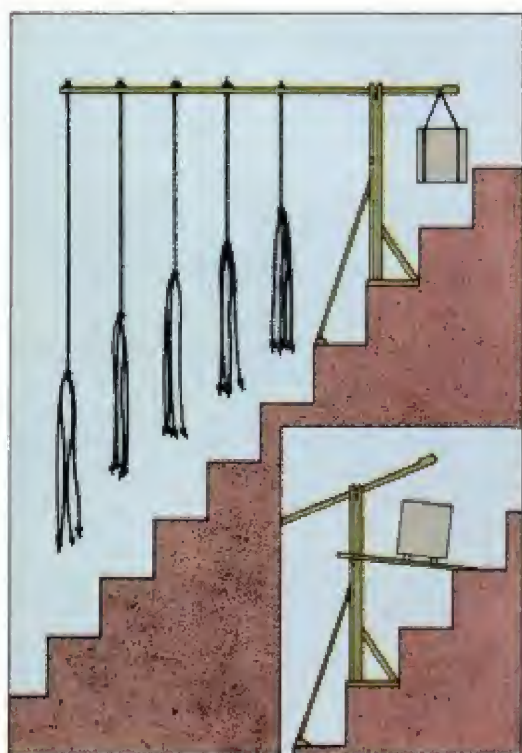
The Greek mechanical designer Hero, who lived during the first century, built a "magical" device for opening temple doors when a ceremonial fire was lit: Heated air inside altar (A) causes pressure to increase inside the sphere (B), partially filled with water. Water is forced through a siphon (C) into a basin (D), which sinks, operating a counterweighted pulley system. Quenching the fire would then reverse the entire process through reduction of air pressure.

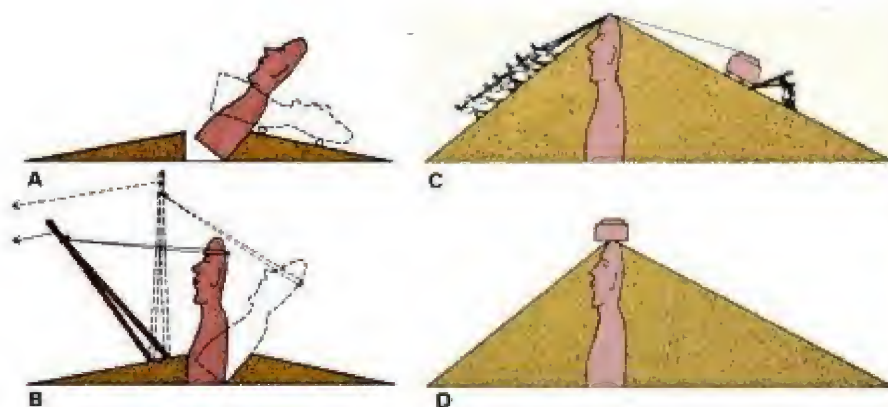


Late in the 17th century, Swedish engineer Christopher Polhem was manufacturing machine components—mass production—in his "mechanical laboratory." He produced 80 devices which represented all known mechanics; among them this mechanism transforming rotary movement of a vertical axle (A) into the reciprocating movement of two pairs of parallel rods (B, C, D, E) through a disc (F) toothed along half of its periphery driving a horizontal axle (G).



The secret of the Egyptian pyramids was nothing more than hard work coupled with the leverage of a human-powered crane derived from the *shadoof*, the age-old system for lifting water from the Nile for irrigation. A multitude of laborers on the crane's long end hoisted the stone block to a point where a ramp and rollers would take it to the next level of the pyramid's steps. The crane then was moved up a step and hoisting process was begun once again.





To a primitive culture, the ramp was a true machine—forerunner of the wedge and screw. The Stone Age culture which erected the strange statues on Easter Island left no clues, but leading theorists suggest this means of construction: (A) Transported on rollers, finished 30-ft. statue is tilted from ramp into shallow ditch. (B) Rope connected to lever raises it to final position. (C) Ramp is built up to move red stone "headgear" to its final position (D).

Submerged in the mighty achievement of his steam engines was James Watt's brilliance as an innovator of basic mechanical systems. His sun-and-planet drive gave rotary motion to a piston action but was also a way of avoiding the crankshaft and connecting rod—known since the Middle Ages but cleverly patented by a rival of Watt's. Reciprocating movement of beam (A) was transmitted to "planet" gearwheel (B) which meshed with "sun" (C) on the flywheel (D) axle.



Two from John Deere's new five-model line, a free-air Spitfire leads a liquid-cooled, oil-injection Liquifire down a trail.



Speed specialist Dan McCue races Kawasaki's new long-range Invader 440 machine up a slope over 11,000 feet high in the Andes.



Snowmobiling— the sport that's come of age

Before test run in the Rockies, drivers of Ski-Doo Everest 500, Moto-Ski Futura and Ski-Doo Blizzard (from left) check slope.



A redesigned Panther joins five other full-size Arctic Cats and the mini Kitty Cat for its 1980 lineup.



Performance leader for Polaris, the TX-L Indy has independent front suspension with coil springs-over-shocks for smooth ride.

This winter nearly 20 million Americans will ride these machines for cold-weather fun.

by Bill McKeown OUTDOORS EDITOR

It gets more people in action in the snow than downhill skiing (12.4 million) or cross-country (3.5 million). Nearly \$2 billion will be spent as families explore 190,000 miles of trails. Don't rate the snowmobile as a fad anymore.

Twenty years ago there were 130 snowmo builders and now there are only six—Arctic Enterprises with Arctic Cats and Scorpions, Bombardier making Ski-Doo and Moto-Skis, John Deere, Kawasaki, Polaris and Yamaha. But all look as if they are here to stay to ser-

vice what is called the third-fastest-growing sport, behind tennis and skiing.

Noise, once a big complaint, has been reduced 94 percent in 10 years. Industry safety standards, driver education and improved trails have helped reduce accidents while the sport has been expanding. Gasoline used by snowmobiles is only $\frac{1}{10}$ of one percent of total U.S. gas consumption, three-fourths of 1 percent in Canada. Extensive studies by Arctic Cat show their machines average 21.8 mpg with some reaching 32.9.

Best-performing new 1980 models we have tested are Kawasakis, brought in by AeroPeru Airlines to the high slopes of the ski resort at Portillo, Chile, where the downhill speed-skiing record of 200 km per hour was set. The South American Andes are just becoming a

(Please turn to page 164)



Top of the Kawasaki line, new Invader LTD 4/6 has 440-cc liquid-cooled engine, CD ignition, Vari-Ride progressive suspension.

The only side-by-side machine, Ski-Doo Elite with bucket seats provides heated handlebar grips, electric start, rear trunk.



Light weight of 352 pounds gives the new Moto-Ski Mirage special flotation in powder snow. The 368-cc engine uses dual carbs.



More powerful this winter, Arctic Cat's line-leader El Tigre 6000 (above) mounts a liquid-cooled, 500-cc engine, disc brakes.

SnoPro racer from Ski-Doo, Blizzard 9500 Plus, liquid-cooled, 437-cc performance machine has CD ignition, tuned exhaust.

GRAND DESIGN

STANDARD CABINS

PASSAGEWAY

BREAKFAST NOOK

LUXURY
CABINS

STEERABLE
TRAILER AXLE

GENERATOR &
ACCESSORIES
COMPARTMENT

ENGINE
COMPARTMENT

Articulated design makes the 59-ft. bus very maneuverable. Dinette converts to bunk in luxury cabin.

Breakfast nook is complete with microwave oven; cabin attendant is cook for breakfasts, light snacks.

Sightseeing is top attraction; but stereo movies are also on tap. The bathroom's snug, but fully equipped.



HAVE ROOM, WILL TRAVEL

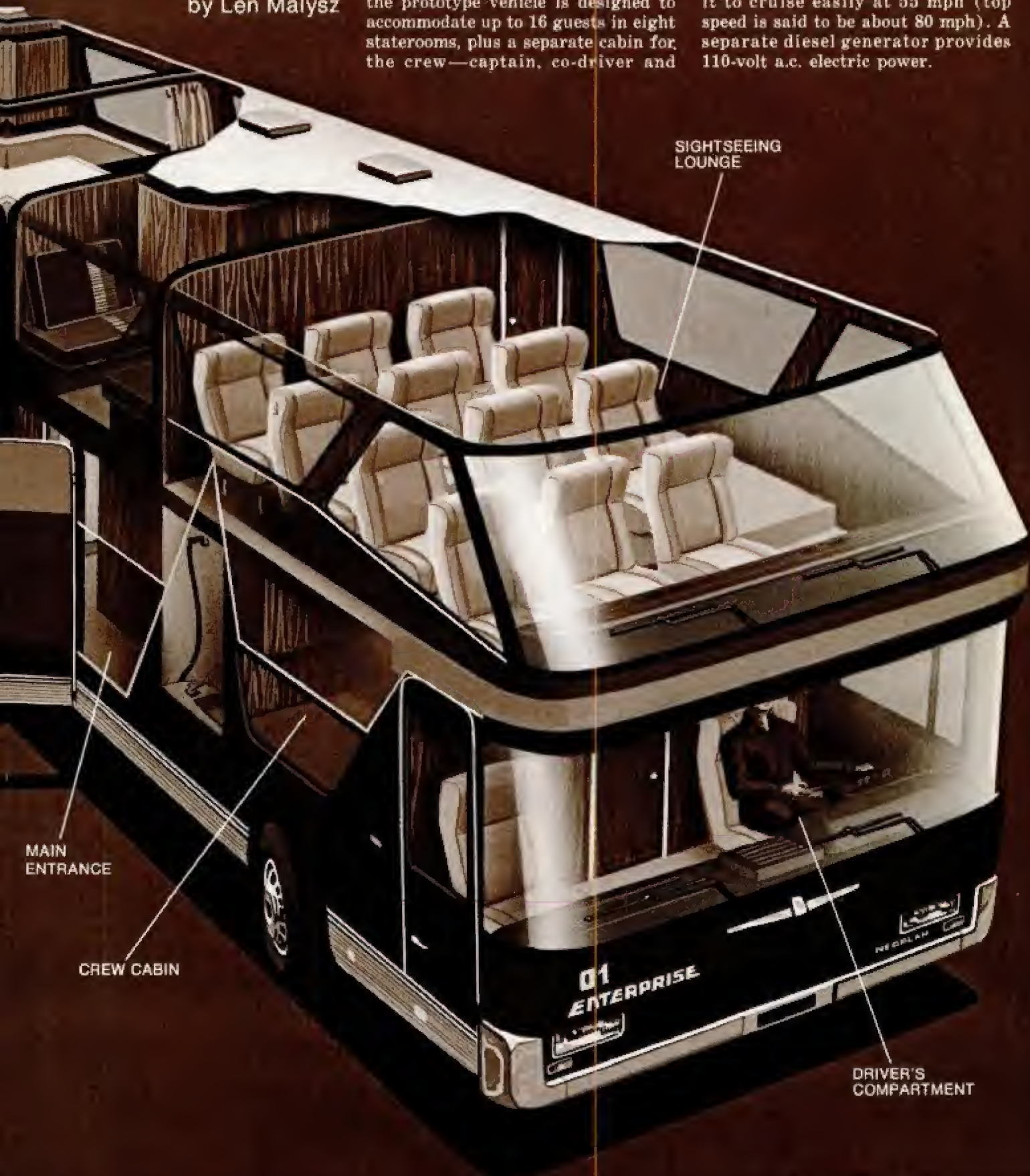
The ultimate tour bus is a hotel that checks out with you.

by Len Malysz

No, it's not a movie set—the 59-ft. articulated bus that's called a Car-O-Tel really exists. Commissioned by Dutch entrepreneur Fred Nauta, the prototype vehicle is designed to accommodate up to 16 guests in eight staterooms, plus a separate cabin for the crew—captain, co-driver and

cabin attendant.

The European-built colossus weighs 26 tons and is powered by a 320-hp Mercedes-Benz engine which enables it to cruise easily at 55 mph (top speed is said to be about 80 mph). A separate diesel generator provides 110-volt a.c. electric power.



Gas-saving gadget

Dear Car Clinic," wrote P. Perry of Downey, Calif., "There are all kinds of ads in regard to gasoline mileage savers. Are any of these gadgets any good?"

Reader Perry's question sums up what's on the minds of many others. Therefore, discussing gasoline-saving "gadgets" as part of PM's Fuel for the Future series is a necessary undertaking.

As I travel the country looking for people who have found new ways to get out of the fuel mess we're all in, I meet dozens of "gadget" inventors. To hear each one



by Mort Schultz

tell it, his device is our salvation.

Some gadgets are worthwhile, and it's these we'll be reporting on. My articles will cover devices I've tested personally, or those whose value is attested to by independent

which won't do a thing for you in your gas tank, but maybe his variable closed throttle positioning control will.

The Noiles Knee—which is more

testing laboratories or users who have no ax to grind.

Another factor bearing on whether we report on a device is its availability. If you can't get the "gadget" or information to make it yourself, what good is it?

The following, then, is the first of several articles on "gadgets." How many others will there be? As I sit writing this in Horseshoe Bend, Ariz., I can promise at least several more. It will ultimately depend on how many legitimate fuel-saving inventions I run across in other U.S. "Horseshoe Bends."

Douglas G. Noiles is a mechanical engineer who is vice-president for research at United States Surgical Corp. in Stamford, Conn. He is also the inventor of the Noiles Knee,

accurately called the Noiles Total Knee Prosthesis—is a piece of space-age metal they put inside a person whose knee is disease-deteriorated. It is as much advanced from its predecessor as ball-joint front suspension is from kingpin front suspension. The predecessor allows a patient to flex his knee. The Noiles Knee allows him to flex and, miraculously, pivot his leg, as well.

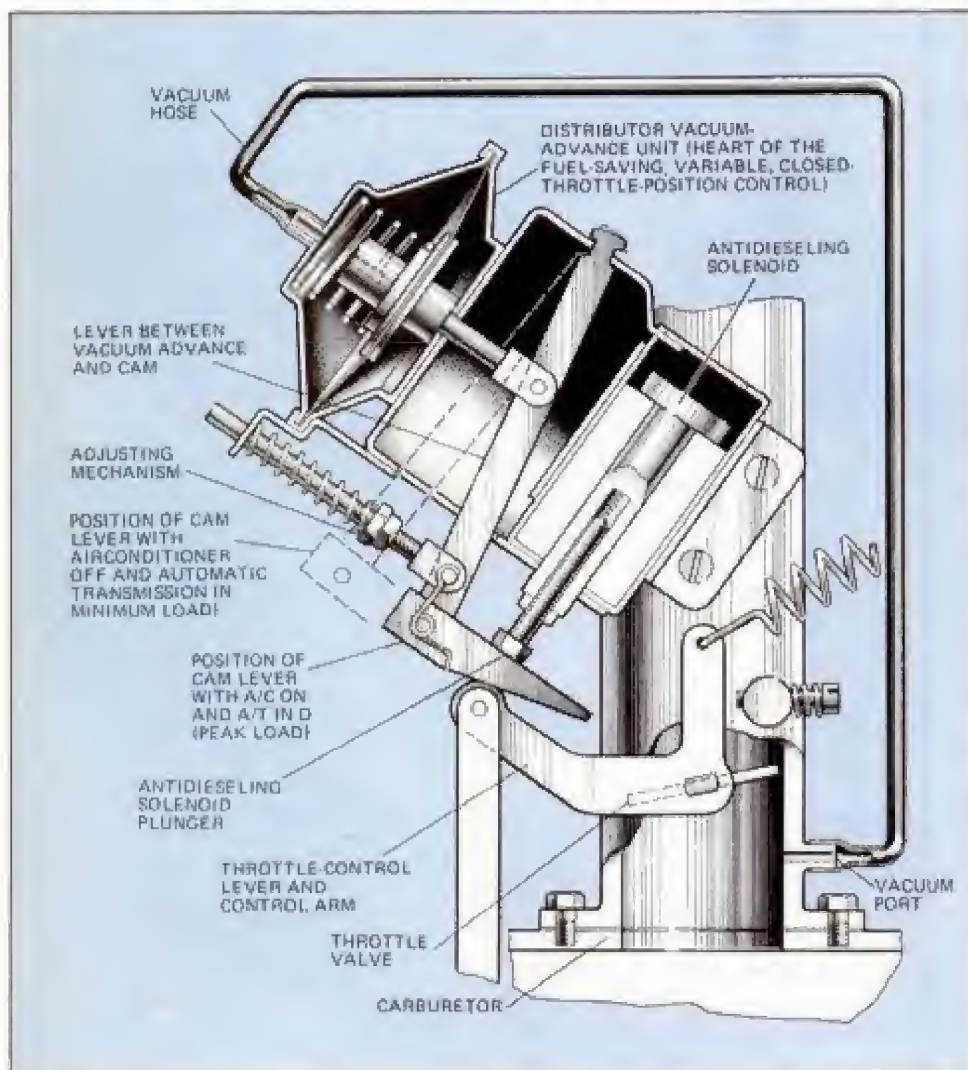
Throttle positioner

You can understand why I listened intently when Doug Noiles told me about his . . . Heck, let's call it his throttle positioner. His credentials as an inventor of surgical devices are impeccable.

Noiles got started in the "car business" in 1970 when he bought a new Checker sedan equipped with a six-cylinder Chevrolet engine, automatic transmission and airconditioner to supplement his 1968 Checker possessing the same engine with standard transmission. He had been getting an overall 20 miles per gallon with the '68. With the new car he got only 12 mpg . . . "until my invention changed that," he claims.

Noiles put most of the blame for the sharp drop in fuel economy between the two cars on the automatic transmission, which requires, when not under load, high-engine-idling speeds to operate properly when both the transmission and airconditioner are engaged. This condition necessitates a more open "closed throttle" than is needed when the engine is idling, the transmission is in NEUTRAL and the airconditioner is off.

According to Noiles, "Ford and



Throttle positioner is Doug Noiles's way of getting more mpg from his car. The device, the heart of which is a vacuum advance unit, is installed on carb.

...that works!

General Motors have several patents for an idle throttle positioner, which would allow the engine to idle at a lower rpm with transmission and air-conditioner engaged, but none works with antidieseling solenoids."

Idle-stop solenoid

Manufacturers began installing antidieseling solenoids on most vehicles in 1970. The antidieseling solenoid (also known as idle-stop solenoid) helps to prevent engine run-on, which is a result of higher engine operating temperatures that are needed to control emissions.

The antidieseling solenoid is an electrically operated unit. When the engine is running at idle speed, the control arm (plunger) of the solenoid pushes against the throttle-valve lever to keep the throttle valve open enough so the engine won't stall. When the engine is turned off, the plunger draws away from the throttle-valve lever. This allows the throttle valve to close promptly, which prevents the fuel mixture from entering the cylinders. Dieseling occurs when residual gasoline in the cylinders is ignited by high temperature.

According to Noiles, a drawback of the antidieseling solenoid is that it does not make allowance for various engine-load conditions. An antidieseling solenoid is adjusted to keep the throttle valve set to accommodate the engine under its heaviest idling load; that is, as if the engine is idling with the automatic transmission in DRIVE and the airconditioner on.

Variable settings save fuel

Under other idling conditions—transmission in DRIVE and A/C off, transmission in NEUTRAL and A/C on, transmission in NEUTRAL and A/C off—a slower idling speed would suffice and less fuel would be consumed if the idle-stop solenoid would provide variable settings.

As Noiles says: "Engines with automatic transmissions idle too fast and have a closed-throttle (idling) position which is open too much, especially when the car is coasting, or idling, with the driver's foot off the gas pedal."

The National Bureau of Standards agrees. George P. Lewett, chief of the NBS office of energy-related inventions, wrote Noiles: "The idea of a position control is worthwhile and it

could save fuel, because there is a tendency for automobiles with automatic transmissions to idle faster than necessary."

However, the government won't fund Noiles's invention under the Appropriate Technology Program (see page 118). "Your control operates from manifold pressure, which is not a good indicator of engine rpm or road speed. It is difficult to conclude that such a system could reliably adjust the idle speed in response to load changes," Noiles was told.

"The results speak for themselves," Noiles contends.

Tests show mpg increase

An independent testing laboratory, Scott Environmental Technology Inc. of Plumsteadville, Pa., dynamometer-tested Noiles's 1970 Checker with and without the throttle positioner. With the control, the testing laboratory reported getting a 6 to 6.7 percent increase in mpg.

"I get better than that," Noiles says. "With the addition of radial tires and electronic ignition, the car presently averages 18 mpg, which is 6 mpg better than what I got when the Checker was new."

To prove it, he showed me results the Columbia Taxi Co. of Norwalk, Conn., got when the invention and a vacuum gauge of Noiles's design were put on two company cabs. The vacuum gauge kept drivers aware of the amount of load on the engine so they could adjust driving to attain maximum fuel economy.

One procedure suggested by Noiles was to let the engine idle at traffic lights with the transmission in NEUTRAL—the setting at which the throttle positioner permits maximum fuel savings.

The taxi test was conducted for several months. Results disclosed that fuel economy increased 10 to 15 percent.

The heart of the throttle positioner is an ordinary distributor vacuum advance that you can purchase at an auto-parts counter. The chamber is fitted with a support bracket that allows you to mount the vacuum advance on the antidieseling solenoid.

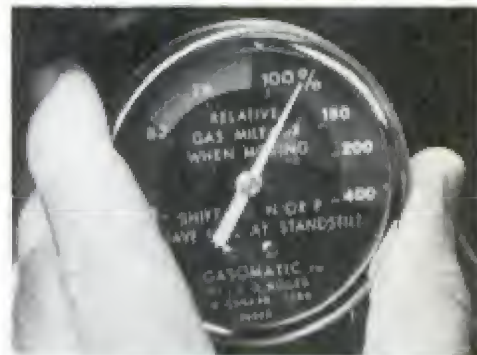
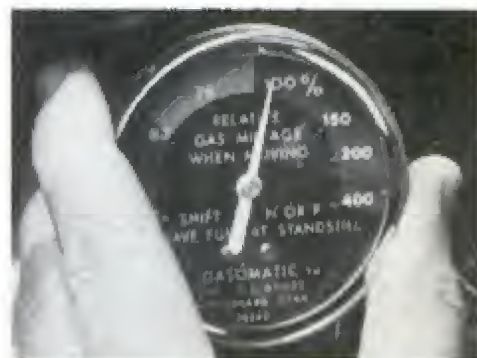
How it works

The vacuum advance is connected by hose to a vacuum port in the base of the carburetor. Thus, the vacuum

advance is able to control, by means of manifold vacuum, the opening of the throttle valve. Here's how.

Keep in mind that engine vacuum is greatest (at idle) when the transmission is in NEUTRAL and the airconditioner is off. Engine vacuum is least (at idle) when the transmission is in DRIVE and the airconditioner is on.

A lever mounted to the vacuum advance controls a cam having straight and inclined surfaces. The cam is interposed between the idle-stop solenoid plunger and the throttle control lever. The straight surface of the cam bears on the idle-stop solenoid



Vacuum gauge shows improvement in mileage on Noiles's car under various conditions with his variable closed throttle position control installed. Top photo shows reading with engine idling in DRIVE and airconditioner on. Center photo shows improved fuel economy with engine idling in DRIVE and airconditioner off. In bottom photo engine idles in NEUTRAL with airconditioner off.

plunger, and the inclined surface bears on the throttle control lever.

As the cam moves according to the amount of vacuum the vacuum-advance unit receives from the engine, it allows the idle-stop solenoid plunger to retract or extend a lesser or greater amount. This places the throttle control lever and, therefore, the throttle valve in position to meet varying curb idle conditions.

Also, when the car is coasting, the vacuum is high, a condition which moves the throttle stop to its most closed position.

How can you avail yourself of the Noiles Throttle "Nudger?" First of all, to get the most from it, your car should have an automatic transmission, airconditioner and antidieseling

solenoid, and it should be driven mainly in stop-and-go situations. At constant speed on a level road, the throttle positioner doesn't do a thing to improve gas mileage.

Noiles told me he would sell his device for \$60 to owners of cars with older six-cylinder Chevrolet engines. These have the antidieseling solenoid mounted on a bracket bolted to the intake manifold. The newer engines are equipped with the antidieseling solenoid built in. Doug Noiles lives at 114 Elm Pl., New Canaan, Conn. 06840.

Adapting to other engines

If you don't have a car with a six-cylinder Chevy engine, you can get a copy of the patent from the U.S. Patent Office in Washington, D.C. It gives

details of the construction and you can try to adapt the device to your engine. The throttle positioner possesses an adjuster which, Noiles says, "enables it to be adjusted to fit smaller or larger engines, new or old." The patent number is 4,056,082 (11/1/77).

When the throttle positioner has been installed, adjust engine curb-idle speed, using the idle-stop solenoid, to manufacturer specification with the engine idling, automatic transmission in DRIVE and airconditioner on (full-load idling speed). Then, with the engine idling, automatic transmission in NEUTRAL and airconditioner off, adjust the throttle positioner so that the "no-load" idling speed will come to within 50 rpm of the "full-load" idling speed. **PM**

How Uncle Sam can help you with your invention

Henry Ford didn't work for a company the size of General Motors. Thomas Edison wasn't employed by an all-encompassing organization like Public Service Electric and Gas of New Jersey. And Alexander Graham Bell? The only Ma Bell he knew was his father's wife.

Tinkering in woodshed workshops, these "small-time" inventors helped spawn present-day giant companies. Ironically, present-day giant companies have made it difficult for inventors working on their own to get their inventions to market. For an inventor to get enough capital to develop an invention, he normally has to turn to a big company, which usually makes company ownership of the invention a condition for funding.

The government, recognizing the historic importance of the individual inventor, is bucking the trend. The Department of Energy (DOE) has two programs to fund inventions relating to energy. As this article is being written, the Department of Transportation (DOT) is developing a program to fund worthwhile inventions relative to highway, air, rail and marine transportation.

It's too soon to describe the DOT program. A PM article about that will

come later, when things are more definite.

The DOE programs, on the other hand, are established. If you have an energy-related invention you think the country needs but you lack money to bring it to market, one of the programs may be worth pursuing.

The oldest of the two is called the Energy-Related Inventions Program. It was established by Congress in 1974.

According to Patrick J. Donohoe, who heads the DOE Inventions Branch, "The idea behind the program is to help individual inventors and small businesses develop, and bring to market, worthwhile inventions that are energy-related."

When an invention passes the screening process, it is funded with the hope that the inventor will be able to do one or more of these things:

- Obtain a contract from private or government sources to further develop the invention.
- Set up a company to manufacture and market the invention.
- Negotiate an agreement with a company that will manufacture and market the invention.

An inventor just doesn't walk into Donohoe's office and, zip, get a few

thousand. The screening process is as tough to get through as the National Basketball Assn. playoffs. There is a limited amount of money to go around, and there are thousands of inventors, each thinking he has an answer to the energy dilemma.

Suppose you have an invention. Your first step is to apply for a patent. Then, write the Inventions Branch, Div. of Business Programs, Department of Energy, Washington, D.C. 20585, for an evaluation-request form. The evaluation request will be reviewed by the National Bureau of Standards.

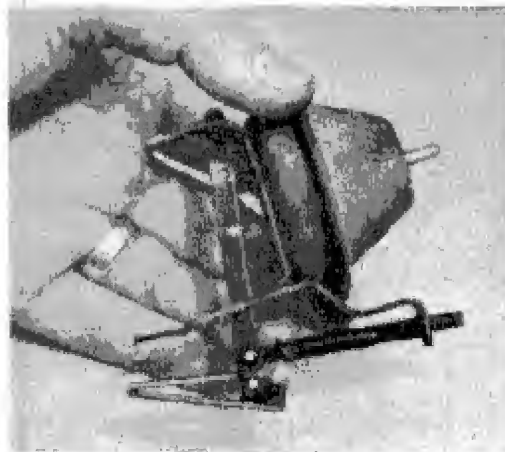
At this point, over half of the applications fall by the wayside. The main reasons are incomplete, technically insufficient or hard-to-understand descriptions, and the existence of concept, rather than a working invention.

An invention may take up to a year to get through the preliminary evaluation. If it survives, it enters the next stage, which is a technical review by two specialists in the particular field. Each specialist works independently of the other. The specialists look for obvious technical flaws. This process takes about eight hours.

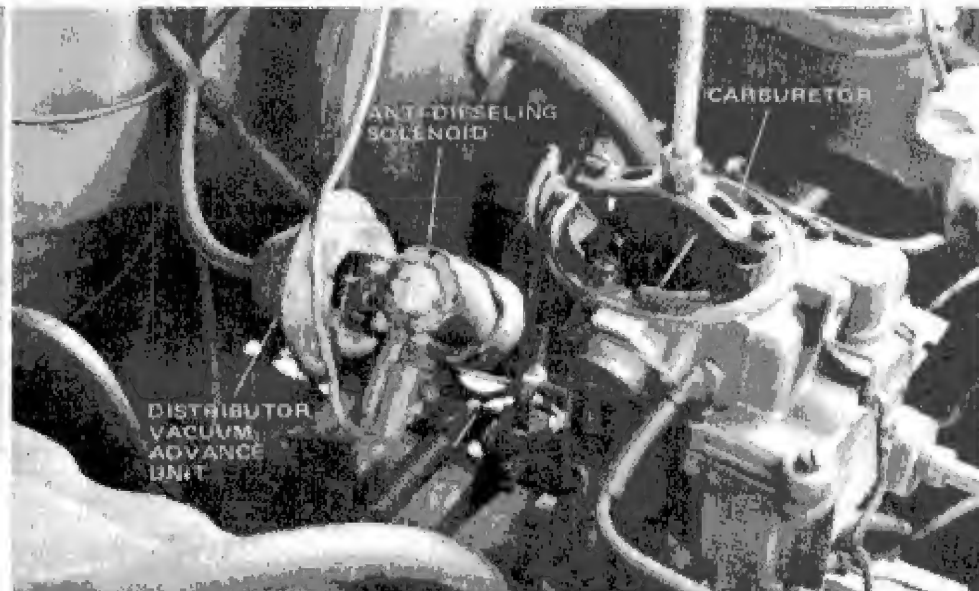
In 1978, over 10,000 evaluation requests were received. Only five percent of these proposals saw the light of hope at the end of the technical review.

Those inventions that do survive this phase enter the final stage of evaluation, which is in-depth testing and analysis by a staff engineer who probes both the technical and commercial feasibility of the invention.

"No energy is saved unless people are able to buy and use a device," says David G. Mello, who, along with Glen A. Ellis, works in Donohoe's of-



Distributor vacuum advance unit is the heart of the throttle positioner, which is pictured above. At right, the positioner is installed at the antidiesseling solenoid on the carburetor.



fice to coordinate the evaluation process. "An invention has to be both possible and marketable to be of any value. If an invention is too expensive for people to buy, it's not practical. In other words, we are not interested in devices that use platinum ball bearings."

After this final evaluation, DOE decides the nature and extent of support each invention will receive. Of the 500 or so inventions that reached this stage in 1978, about 7 percent survived.

In terms of numbers, then, of the more than 10,000 inventions received in 1978, a scant 34 received support. But this support was to the tune of \$2.3 million. The smallest award was \$18,000, the largest was \$170,000 and the average was \$67,000.

Dollar amount is one criteria that distinguishes the Energy-Related Inventions Program from the Appropriate Technology Small Grants Program, which is the other DOE program. A cap of \$50,000 is placed on funds allocated to an inventor under this program. Some inventors have received as little as \$300 aid-money. However, neither extreme is the rule, since grants average about \$10,000.

The Appropriate Technology Program looks for people who have energy-saving concepts (no hardware) or working inventions to meet specific needs of the local community, with a minimum expenditure of money and manpower needed to put the invention into use. In other words, under the act by Congress authorizing DOE to set up this program, DOE has been charged with providing grants for the development of "small-scale, energy-related technologies that are appropriate to local needs and skills."

In addition to individual inventors, Appropriate Technology grants are given to:

- Local nonprofit organizations, and state and local government agencies. One grant for \$8500, for example, went to Nevada State University in Las Vegas, which is working with an invention that combines evaporative cooling and solar heating that uses air, instead of water, as a conductor. If successful, the equipment will be valuable to the southwestern areas of the United States should a predicted water shortage develop.

- Indian tribes. For instance, as part of a campaign to prove the effectiveness of solar energy methods, the Yavapai Council for the Aging in Prescott, Ariz., was awarded \$2000 to install a solar hot-water heater in a building used by senior citizens.

- Small businesses. For example, Solar Aqua Systems, a small business firm in Encinitas, Calif., has an \$8000 grant to develop a covered, solar-heated lagoon for primary anaerobic treatment of waste water that will produce methane for supplementary heating.

Screening of proposals submitted to the Appropriate Technology Program is no less rigid than those offered to the Energy-Related Inventions Program. A proposal goes through four evaluation steps:

1. A prescreening of applications.
2. A technical review by experts drawn from the region involved.
3. A review by qualified individuals from the state in which the project is to take place.
4. A final assessment by a DOE selection panel.

If you think you have an invention, or an idea for an invention, that qualifies under the Appropriate Technol-

ogy Program, write the DOE regional office that serves your locality for more information and a grant application. There are 10 regional offices as follows (address your letter to the Department of Energy, Attn.: Appropriate Technology Program):

Region I: 150 Causeway St., Boston, Mass. 02114 (serving Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut).

Region II: 26 Federal Plaza, New York, N.Y. 10007 (serving New York, New Jersey, Virgin Islands, Puerto Rico).

Region III: 1421 Cherry St., Philadelphia, Pa. 19102 (serving Pennsylvania, Virginia, West Virginia, Delaware, Maryland, District of Columbia).

Region IV: 1655 Peachtree St., N.E., Atlanta, Ga. 30309 (serving Kentucky, Tennessee, North Carolina, Mississippi, Alabama, Georgia, Florida, South Carolina).

Region V: 9800 South Cass Ave., Argonne, Ill. 60439 (serving Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio).

Region VI: 2626 West Mockingbird Lane, Dallas, Tex. 75235 (serving New Mexico, Oklahoma, Texas, Arkansas, Louisiana).

Region VII: 324 East 11th St., Kansas City, Mo. 64106 (serving Missouri, Nebraska, Iowa, Kansas).

Region VIII: Box 26247, Belmar Branch, Lakewood, Colo. 80226 (serving Montana, North Dakota, South Dakota, Wyoming, Utah, Colorado).

Region IX: 111 Pine St., 4th Floor, San Francisco, Calif. 94111 (serving California, Nevada, Arizona, Hawaii).

Region X: 1992 Federal Building, 915 Second Ave., Seattle, Wash. 98174 (serving Washington, Oregon, Idaho, Alaska).—M.S.

A registered nurse in California told us what attracted her to her new Honda Prelude: "I wanted a sporty-looking car," she said, "with good gas mileage. I really liked the Prelude's styling."

That statement sums it up for 67 percent of the Prelude owners we surveyed. Sporty design proved to be the car's No. 1 drawing card, followed closely by economy. And the fact that Hondas run on regular, leaded gasoline clinched the purchase for nearly 16 percent of our respondents.

Owners of Preludes with the five-speed manual gearbox reported getting 3 to 5 mpg more than those who opted for the Hondamatic. That should come as no surprise when you consider the mechanical differences between manual- and automatic-transmission Preludes.

First, the two top gears on the five-



Wide stance, low roofline add to car's sportiness. Power unit is from Accord.

PM OWNERS REPORT: HONDA PRELUDE

speed are overdrive ratios: 0.89:1 and 0.71:1 respectively. The Hondamatic, meanwhile, has only two forward gears, top being direct drive (1.00:1). Add to that the fact that Hondamatic-equipped Preludes run engines that are detuned by five hp (for a flatter torque curve), and you begin to see why the five-speed gives measurably greater fuel efficiency.

Not that Prelude owners expressed disappointment with the gas mileage they were getting. Even those with Hondamatic were pleased with their reported 24.0/28.5 city/highway mileage. Five-speed drivers averaged out to 27.1/33.3 mpg. Since the Prelude weighs the same as the Honda Accord and since it uses the Accord's engine and running gear, performance and fuel consumption are very

similar for these two automobile lines.

As mentioned, looks and economy proved the Prelude's two primary attractions, but they were by no means alone. "I bought my Prelude for the total package," states a New York personnel manager. "I took into account the proven Accord CVCC engine, the front-wheel-drive powertrain, the economy, styling, handling, outstanding craftsmanship in assembly and finish, plus the fact that no options are needed when you buy a Prelude."

There's no doubt that Prelude buyers have the highest regard for the quality of their automobiles. Fully 96.1 percent rat-



Speedo, tach needles share central dial. Owners object to awkward radio controls.

ed Honda workmanship good to excellent. That's within one percentage point of the Accord and right up there with our other top runners, including Mercedes, Volkswagen and Audi. It's slightly above

BY MICHAEL LAMM WEST COAST EDITOR

Owners point to good looks, great handling, fine gas mileage, but bemoan tight rear seat

Glass sunroof is standard and power-operated.

Four-cylinder CVCC engine needs no catalytic converter, burns regular fuel.

Prelude's all-independent suspension comes via MacPherson struts fore and aft.



Photos by the author

the rating Volvo owners gave their cars, 14.6 percent above Jaguar, and 38.1 percent above Firebird.

A Nebraska auto mechanic mentioned, "If American manufacturers could make a car as well as a Honda, I'd buy one. But as long as Honda builds cars with the quality of my Prelude, I'll keep buying Hondas and making my living repairing American cars."

A New York civil servant asserts, "Detail finish work inside the car seems particularly well done." A 19-year-old West Virginia construction worker notes, "I worked in a parking garage for a while and drove every make of car built. The Prelude's workmanship and overall quality stands up to a \$24,000 BMW!"

Relatively few Prelude owners reported mechanical problems of any sort—only 30.1 percent. Among those, the most common complaint centered on the carburetor, notably hesitation on acceleration and slight surging at cruising speeds. The sparkplug gap also tended to erode in some engines, causing misfiring. But most owners' experience with their dealers' service departments involved only routine maintenance.

"My dealer provided me with a maintenance book," beams a New York barber, "that lists a guaranteed price for each service interval and procedure. This is a great idea and eliminates the surprises you so often encounter when doing busi-

ness with other automobile dealers."

Dealer service, in general, came in for above-average marks, with 67.3 percent of the owners we surveyed rating it good to excellent. That's about the same as the way Toyota owners feel about dealer service, but it didn't quite match the score Toronado drivers gave Olds dealers. Even so, it beat Mustang owners' rating of Ford dealers by nearly 17 percentage points.

Honda bills the Prelude as a 2+2 sport coupe and makes no pretense about the rear seat. It's strictly for occasional use, preferably by children.

(Please turn to page 170)



Crosswise Four delivers 90 hp with 5-speed or 85 hp with Hondamatic, burns regular.

A Prelude profile

Honda added the Prelude to its Civic/Accord line last April. The Prelude shares the Accord's 1751-cc (106.8-cu.-in.) overhead cam transverse engine, its five-speed and automatic transaxles, and even its basic all-independent suspension system. But the Prelude's monocoque body is totally new and all its own.

The Prelude enters Honda's marketing plan as a sporty Accord spinoff—a flashy 2+2 notchback coupe. Wheelbase stands 2.4 inches shorter than the Accord's (91.3 inches). Yet both cars weigh the same: 2100 pounds.

Like other Hondas, the Prelude's CVCC four-cylinder engine needs no catalytic converter and runs on regular, leaded fuel. The automatic's engine is tuned for a flatter torque curve and five fewer hp.

The Prelude five-speed's two top gears are overdrive ratios. And the five-speed's axle ratio is 4.61:1. This contrasts with the Hondamatic's 4.11:1 axle. The automatic gives slower acceleration and, due to slippage and lack of overdrive, slightly higher fuel consumption (see chart, page 171).

Standard equipment includes a powered glass sunroof, AM/FM radio, steel-belted radial tires, tach, clock, graphic light display, reclining bucket seats, and rear-window defroster.

Rumor has it that the Prelude's floor pan and suspension will form the basis of a new lightweight Honda sports car—a two-seater with two-liters. It's just a rumor so far, but perhaps that's why they call this the Prelude.

A NATIONWIDE SURVEY BASED ON 1,424,508 OWNER-DRIVEN MILES

Rear-window defroster is one of Prelude's many no-cost extras.

No problem carrying golf bags and conventional luggage in Prelude's large trunk, but a few owners would prefer a passageway to rear-seat compartment.



Big trunk, 13-gal. tank, high mpg make this an ideal long-distance runner.

Rear sway bar augments 175/R70-13 tires for improved handling.

FROM OUR SHOP TO YOURS:

12 Gifts you can

by Harry Wicks HOME AND SHOP EDITOR

One of the great pleasures for a workshopper, I think, is the joy you get when you give away something you have crafted with your own hands. To help you earn that feeling for yourself this Christmas, we've created a collection of attractive, easy-to-make, functional projects. Whether you elect to build something for the house (Nos. 5 or 9, for example) or a toy that a child will treasure the rest of his life (Nos. 6, 7, 8), you will have just as much fun making the projects as giving them away. Complete instructions for all 12 gifts start on the next page; use the color pictures as a painting guide. And, from our house to yours, a very Merry Christmas!



Here's a bagful of projects for Santa to put under your tree.

1 Our rewarded film-editor's slate can be used as a home movie titler. **2** and **3** Stuffed, plaster-coated gloves make delightful towel and cup holders for a teen-ager's room. **4** Our "xylophone" is more for wall decoration than music making. But, after the holidays, you can let your toddler make his own brand of music. **5** Holiday wall bar adds to party merriment. **6** and **7** Whimsical, stylized cat and dog pull toys are fun to make and play with. **8** A toy train is sure to become a family classic.



make and give



9 Our four-drawer spice box, a replica of a pine antique, is fashioned of mellow maple and finished with a satin varnish. **10** Contemporary cutting board is sized to suit the bowl you give with it. When not needed, the stainless-steel bowl stores conveniently between the cutting board legs. **11** These brightly painted hangers are a variation of the plastic hangers sold in boutiques nowadays. We used 3/8-in. A-D plywood to make the ones shown; they're finished with a new latex paint that gives a super glossy finish. **12** See next page.



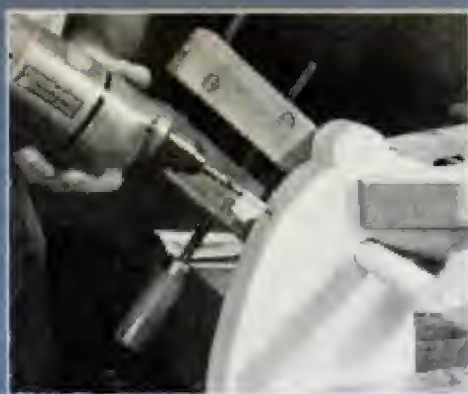
12 Hobby horse

Though the horse is one of the largest projects in our collection, it is also one of the easiest to build. The toughest part of the job is locating the filler strips—D, E, F, G—which are needed to balance the horse in the rest position; this is explained in Step 7.

1. Start by gluing up 5/4-in. pine stock for the head. Use white glue and clamps. Leave the boards clamped overnight.

2. Next day, lay out the head—note grain direction—and make the cutout using either a scroll or sabre saw. Locate and bore holes for eyes and hand bar (H). Sand all edges and set aside.

3. Cut two pieces of plywood for the rockers and—in the waste area—tack them together with 1-in. brads. Draw the outline on one side and cut out both sides at this time with a sabre or scroll saw.



Use clamps to hold hand bar rigid, clamp head in vise, bore hole for dowel plug.



Next, bore pilot hole and drive in 16d nail (carefully) to pin the dowel hand bar.



Use a heavy nailset to bury the nailhead well into the counterbored hole.



Cut a length of dowel to suit and install it using a small amount of white glue.



Blind grooves for rocker's sides are created by gluing in small blocks as shown.

4. Check plywood edges for voids and fill if necessary. Sand all edges smooth.

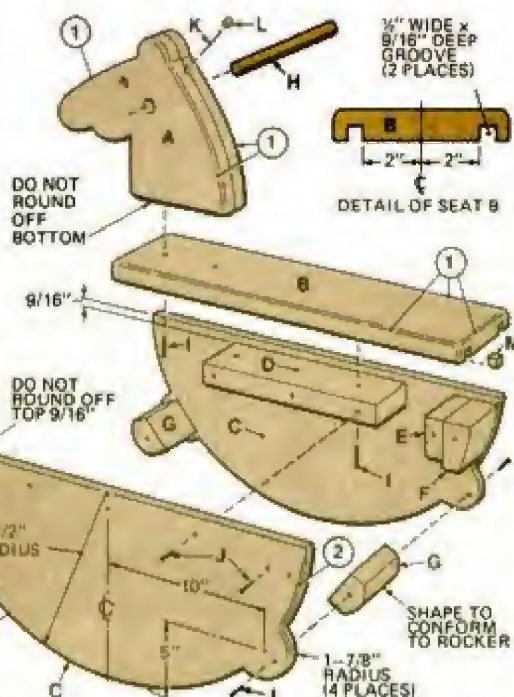
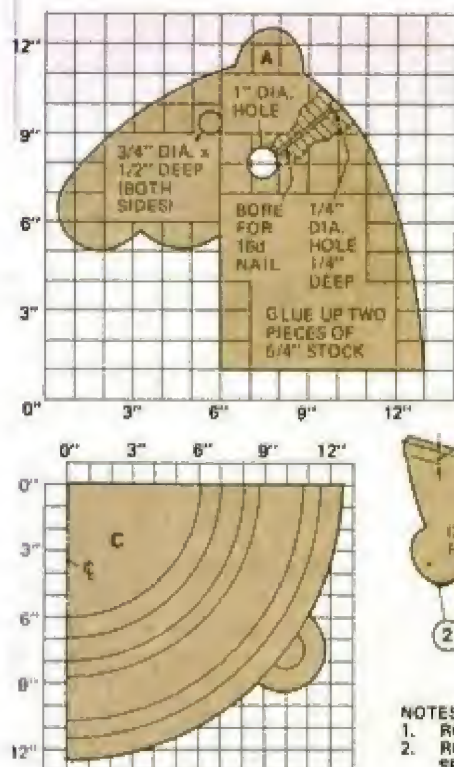
5. Cut the board for the seat and using dado cutters on the bench saw plow the pair of grooves to receive the ply rockers.

6. Temporarily assemble the horse using screws (only) up through the seat into the head. Tack with nails through the grooves into ply rockers. Stand horse on level surface and check it for balance.

PM photos: color, George Raika; black and white, Harry Wicks. Technical art, Eugene Thompson. Designs: Nos. 1 and 9, Harry Wicks; Nos. 2, 3, 4, 5, and 10, Doug Eisman; Nos. 6, 7, 8, 11 and 12, C. J. Gastelberry. Wood construction, Harry Wicks. Special materials: Wheels for toys, train smokestack by Lovebuilt, 2907 Lake Forest Rd., Box 5459, Tahoe City, Calif. 95730 (send \$1 for catalog). See how-to instructions for various projects for specification of finishes.

12 Gaily-painted hobby horse is sure to be one of your youngster's Christmas favorites. Of plywood and pine, its "bump-like" feet protect zealous youngsters from tripping over the horse.





NOTES:
1. ROUND OFF EDGES WITH 1/4" ROUNDOVER BIT
2. ROUND OFF EDGES WITH 1/4" ROUNDOVER BIT SET TO 1/8" DEPTH

MATERIALS LIST—HOBBY HORSE

Key	No.	Size and description (use)	G	2	1 1/2 x 2 1/2 x 4" oak (spacer)
A	2	1/4 x 13 x 13" pine (head)	H	1	1"-dia. x 1 1/4" dowel (handbar)
B	1	1/4 x 6 x 26 1/2" pine (seat)	I	4	2" No. 10 panhead screws
C	2	1/2 x 12 1/2 x 25" plywood (rockers)	J	14	1" No. 10 fl. screws
D	1	1 1/2 x 4 x 1 1/4" oak (cheek)	K	1	16d finishing nail
E	1	1 1/2 x 3 1/2 x 4" oak (cheek)	L	1	1/2"-dia. wood plug
F	1	1 1/2 x 4 x 4 1/4" oak (cheek)	M	4	1/2 x 5/16 x 3/4" fillers

7. To start, cut filler/weight pieces D, E, F and G to the dimensions shown in the drawing. We used dense oak to limit the volume of wood needed. Position the filler blocks as shown and hold each in place with a screw or two until the horse achieves a near-perfect balance in the rest position. Then, either glue and fasten the blocks permanently to the seat's bottom, or make an accurate measured drawing so you can quickly position and fasten them later.

8. Disassemble the horse and sand all exposed parts smoothly. Dust off and reassemble permanently, using glue, screws and nails as detailed. Set aside to dry overnight.

9. Next day, wipe the horse with a tack cloth and seal all parts with a pigmented shellac (Bin or Enamelac). Allow to dry and finish with the colors of your choice; use the color photo on page 124 and the drawing as a guide. The prototype was colored with acrylic paints. For protection, the horse was sprayed with a coat of semigloss varnish.

Note: If the rocker is for a toddler who is still at the "chew anything" age, make certain that you don't use toxic materials to finish the horse.

1 Editor's slate

The slate is a simple, straightforward project that requires very little material.

1. Cut the two pieces of pine (A) to the sizes shown. Miter-cut the end of the top piece and plow the groove in the second.

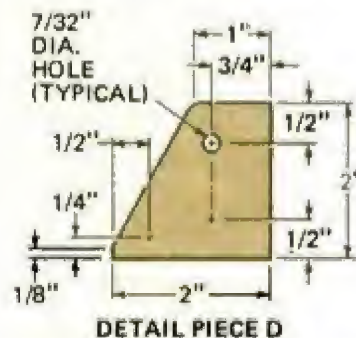
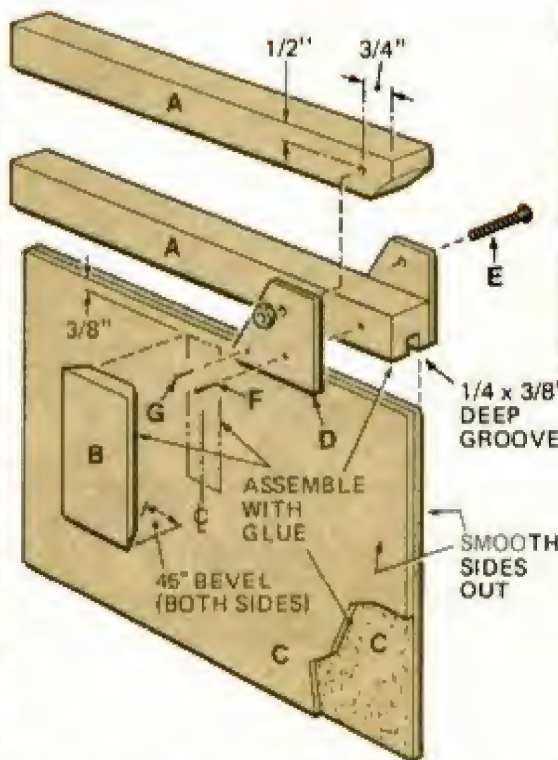
2. Cut two pieces of 1/2-in. hardboard to size, and using white glue and clamps, laminate them together. Then smooth the surfaces.

3. Temporarily assemble parts when dry. Locate and mark for holes to be bored through hardboard for the nut and bolt "hinge." Do not add brads (pins) through hardboard hinge until final assembly. When you're satisfied with the fit and slate operation, disassemble.

4. Sand all parts smooth. Dust and wipe with a tack cloth. Prime them (except edges to be glued) with pigmented shellac, such as Bin. Set aside to dry overnight.

5. Next day, sand lightly with 180-grit paper, dust and tack off. Using masking tape, lay out the white lines and stripes. Mask all other surfaces. Use Krylon's white semigloss paint to spray-paint white areas. Let dry thoroughly before removing masking tape.

6. When paint is completely dry, carefully cover all white-painted surfaces with masking



MATERIALS LIST—EDITOR'S SLATE

Key	No.	Size and description
A	2	1 x 1 x 12" pine (cut from 1/4" stock)
B	1	1/4 x 2 x 4" pine
C	2	1/2 x 8 1/2 x 12" hardboard
D	2	1/4 x 2 x 2" hardboard (hinge pieces)
E	1	3/16 x 1 1/2" rh. bolt and nut
F	2	1/4" No. 8 rh. screw
G	2	1/2" brads
H		Letraset (white letters) No. 67-72 CN
I		1/4" and 1" wide white tape (optional)

Misc.: Sandpaper, tack cloth, flat spray paints.

tape, trim neatly with a utility knife, and press tape edges so they're well secured.

7. Spray the balance of the slate with at least two coats of flat black paint; do not use semigloss because chalk won't take. Allow each coat adequate drying time between coats. Note: If preferred, slate can be primed and spray-painted black. White stripes can be made using white tape (at art-supply stores).

8. When completely dry, remove the tape and reassemble the slate. Add the brad pins (G) through the hardboard hinge to keep the latter from pivoting when the gate is moved.

9. We used self-stick type letters available in art-supply stores. Application directions vary according to brand. Protect letters with a spray coat of matte finish (also at art-supply stores.)

2&3 Plaster hands

1. Glue dowels in holes centered in discs.
2. Stretch glove index finger over dowels.
3. Fill gloves with polyfiber. In cupholder glove, staple cardboard disc—to create a flat surface—to center of dowel.
4. Stuff gloves to resemble hands; staple openings to inside perimeter of wood discs.
5. Mix plaster and dip gloves four times for even coat; set aside, let gloves harden.
6. Insert screw eyes into top of discs.
7. Fold bandanna triangles; tie to hands.
8. Paint towel bar (dowel) bright red. Hang gloves, set towelholder on index fingers. Set a plastic cup on the cupholder hand.

MATERIALS LIST—PLASTER HANDS

No.	Size and description (use)
3	$\frac{1}{4}$ x 6"-dia. discs ($\frac{1}{2}$ " pine)
3	$\frac{1}{2}$ x 10" dowels (gloves)
1	$\frac{1}{2}$ x 16" dowel (towel bar)

Misc.: 5 lbs. Plaster of Paris, 1 bag polyfiber stuffing; large-size soft cotton workgloves, red bandannas; red acrylic paint; staple gun; 3 small screw eyes, one 5"-dia. cardboard disc.

4 Wall xylophone

This is a simple toy that doubles as a wall decoration, too. The separation of wood with weatherstripping, and the different lengths of lattice, give a *slight* tonal variation.

1. Cut parts for base. Oak was used for the prototype. Cut bevel for end rabbets in part K and make repeat passes to required width. Assemble base with glue and dowels. Then sand. Use diagonal braces across two corners to make certain that the unit remains square while glue dries.

2. Sand oak frame, wipe with tack cloth. Seal with two coats of shellac. Let dry overnight before assembling.

3. Cut pieces of lattice to length.

4. Sand, dust and prime lattice strips. Then paint strips red and green (see page 122).

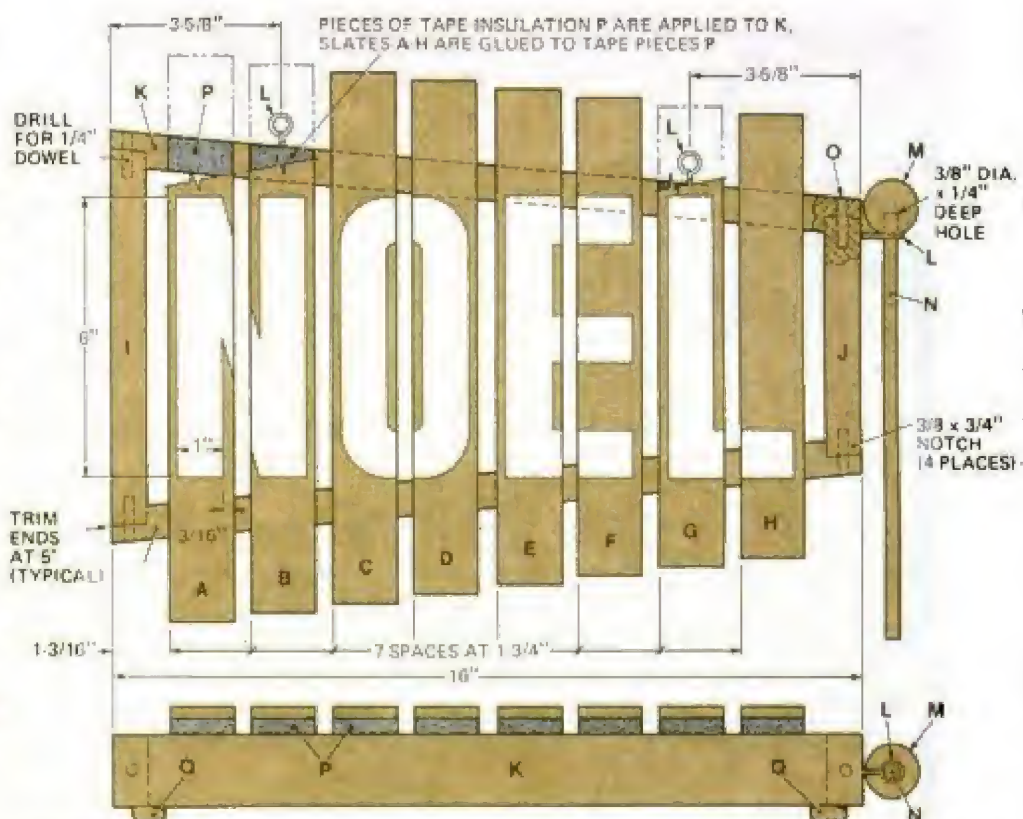
5. Position small strips of weatherstrip as shown. Use an all-purpose adhesive, such as 3M's Superstrength, to affix strips of lattice to weatherstrip pads. Protect lattice with newspaper and weigh down overnight. Next day, for added strength, bore pilot holes through lattice and weatherstrip and add one $\frac{1}{4}$ " finishing nail at both ends of all lattice strips.

6. Add toilet seat bumper "feet," install one screw eye for hanging mallet and two screw eyes for hanging the xylophone.

7. The mallet is made with a commercial wooden ball and a short length of $\frac{3}{8}$ -in. dowel glued into a predrilled hole. You can purchase the wooden ball in a craft-supply house.

MATERIALS LIST—XYLOPHONE

Key	No.	Size and description
A	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x 12" pine lattice
B	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $11\frac{1}{2}$ " pine lattice
C	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $11\frac{1}{2}$ " pine lattice
D	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $10\frac{1}{2}$ " pine lattice
E	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $10\frac{1}{2}$ " pine lattice
F	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $10\frac{1}{2}$ " pine lattice
G	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $9\frac{1}{2}$ " pine lattice
H	1	$\frac{1}{4}$ x $1\frac{1}{2}$ x $9\frac{1}{2}$ " pine lattice
I	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x 8" oak
J	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $5\frac{1}{2}$ " oak
K	2	$\frac{3}{4}$ x $1\frac{1}{2}$ x $16\frac{1}{2}$ " oak
L	3	$\frac{1}{4}$ " i.d. screw eye
M	1	$1\frac{1}{2}$ "-dia. wood ball
N	1	$\frac{1}{4}$ "-dia. x $9\frac{1}{2}$ " dowel
O	4	$\frac{1}{4}$ "-dia. x 1" dowel
P	16	$\frac{1}{8}$ "-thick weatherstripping
Q	4	Nylon toilet-seat bumper



Use a utility knife to cut 16 small squares of weatherstripping from the roll.



Peel paper off, apply squares to oak frame. Next, put adhesive on top surfaces.



Allow glue to set several seconds. Then put slats in position on the little blocks.



Put paper over slats for protection and set a heavy weight on top overnight.

5 Christmas-tree wall bar

Use A-D or cabinet-grade plywood to make this decorative wall bar.

1. Using the grid, lay out tree shape on plywood. Cut with scroll or sabre saw, fill edge voids with plastic wood filler, sand smooth.

2. Round front edges with rounding bit and router, or block plane, file and sandpaper.

3. Cut the stock for the bar and lay out for the corner brace notches.

4. Notch bar and plywood back with a rout-

er. Install bar on tree using screws as shown.

5. Carefully lay out for dowel (glass-holding) rack holes. (Note: check stemware before boring holes in the plywood. The dowels must be closer for small glasses.) Cut saw kerf $\frac{1}{4}$ in. deep in end of each dowel.

6. Apply white glue to kerfed dowel ends; insert dowels in tree holes. Secure dowels in kerfed ends with wedges from back. Let dry

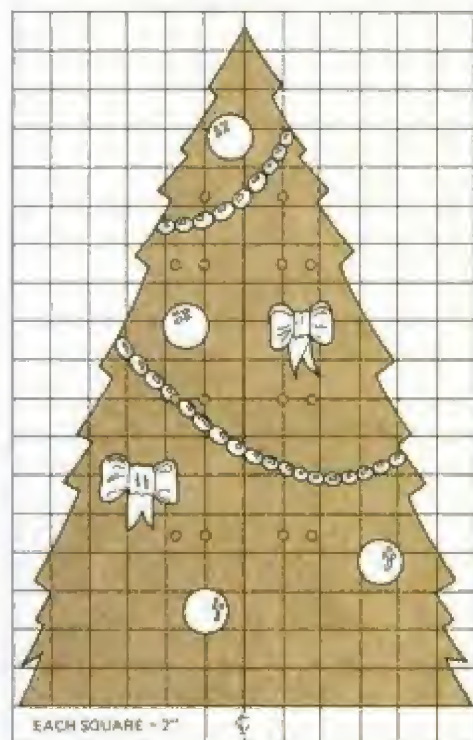
overnight. Prime-paint wood with pigmented shellac (Bin or Enamelac). Let dry, sand lightly with 180-grit paper, dust, tack.

7. Apply a coat of latex green to wooden parts and allow to dry overnight.

8. Use grid drawing to lay out and draw tree "ornaments" on tracing paper. Tape drawings in place on tree with carbon paper beneath. Transfer design to tree with hard pencil.

9. Use acrylic paints and color photo on page 123 as guide to paint tree decoration.

Install hangers as shown; securely mount the wall bracket with screws into a wall stud.

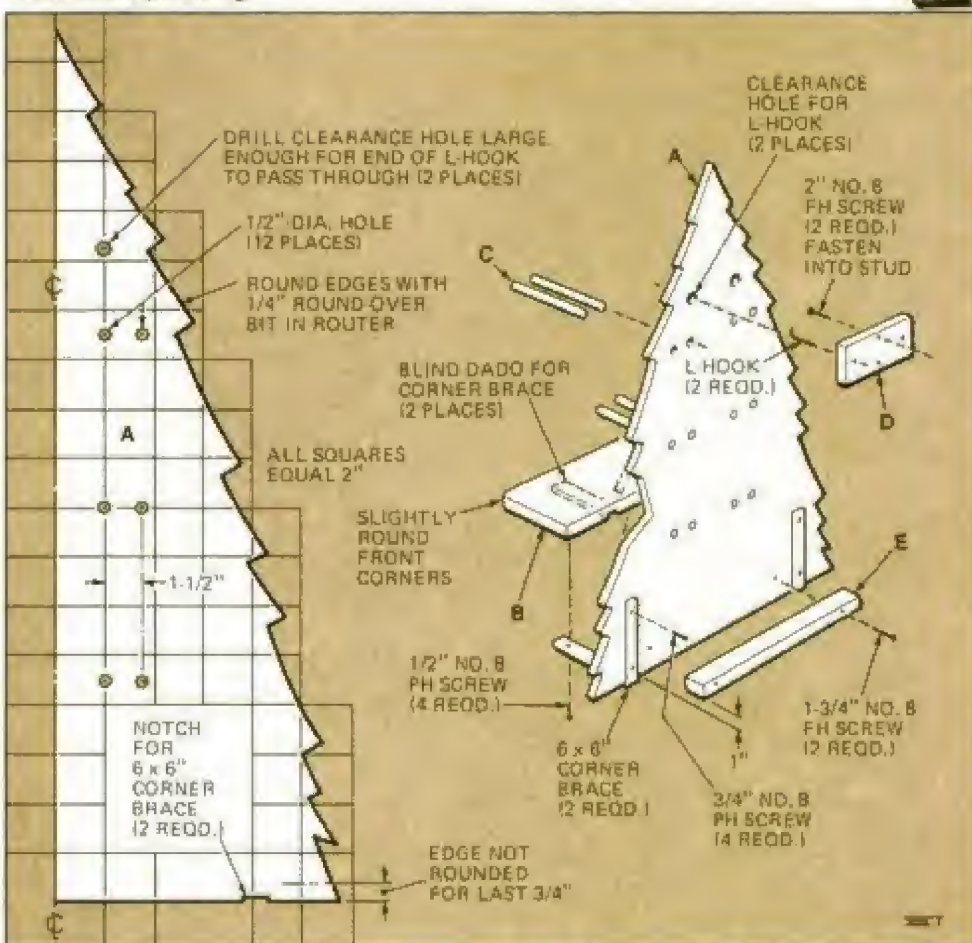


MATERIALS LIST—TREE WALL BAR

Key	No.	Size and description (use)
A	1	1/2 x 24 x 36" plywood (tree)
B	1	1/2 x 5 x 24" clear pine (bar)
C	12	1/2 x 8" dowels (hangers)
D	1	1/2 x 5 x 6" (wall cleat)
E	1	1/2 x 1 1/2 x 20" (standoff cleat)

Misc.: Pigmented shellac (Bin), green latex paint, acrylic paint colors, hardware (see drawing)

CHRISTMAS GIFTS



6 & 7 Dog and cat

For ease of construction, both pull toys are made using glued-up 3/4-in. stock. You can substitute thicker pine, if available, but the cost will be greater. Directions are basically the same for both.

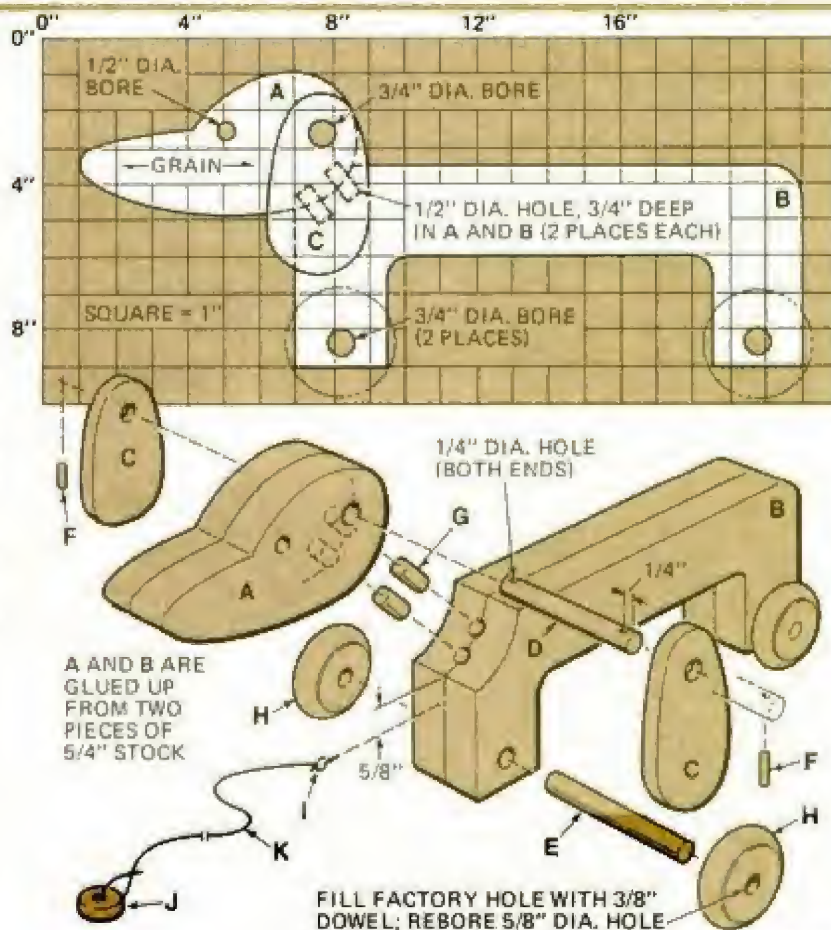
1. Lay out the animal's head on a piece of 3/4-in. stock, making certain that the grain is running in the right direction. Make a square cutoff and cut a second piece for lamination to the first.

2. Apply white glue sparingly to both surfaces and press the boards together. Using scrap-wood pads beneath the jaws to protect the wood, apply pressure to the parts with clamps. Set aside to dry overnight. Repeat this procedure for the body.

3. The next day, cut out the animal parts using a sabre or scroll saw. Be certain to make the outside outline cuts first, and bore the dowel holes for the neck joints before making the

MATERIALS LIST—DOG PULL TOY

Key	No.	Size and description
A	2	1/2 x 4 x 8" pine
B	2	1/2 x 5 1/2 x 14" pine
C	2	1/2 x 3 x 5" plywood
D	1	1/4"-dia. x 4 1/4" ear dowel
E	2	1/4"-dia. x 3 3/4" axle dowels
F	2	1/4"-dia. x 1" dowel
G	2	1/4"-dia. 1 1/4" dowel
H	4	3"-dia. wheel, Love-Built WP-19
I	1	No. 10 screw eye
J	1	1"-dia. wheel
K	1	3/4" drapery cord



CHRISTMAS GIFTS



inside outline cutouts which form the animals' legs.

When all parts are cut, sand them smooth with 120-grit paper, dust and tack off.

5. Bore axle, ear and eye holes.

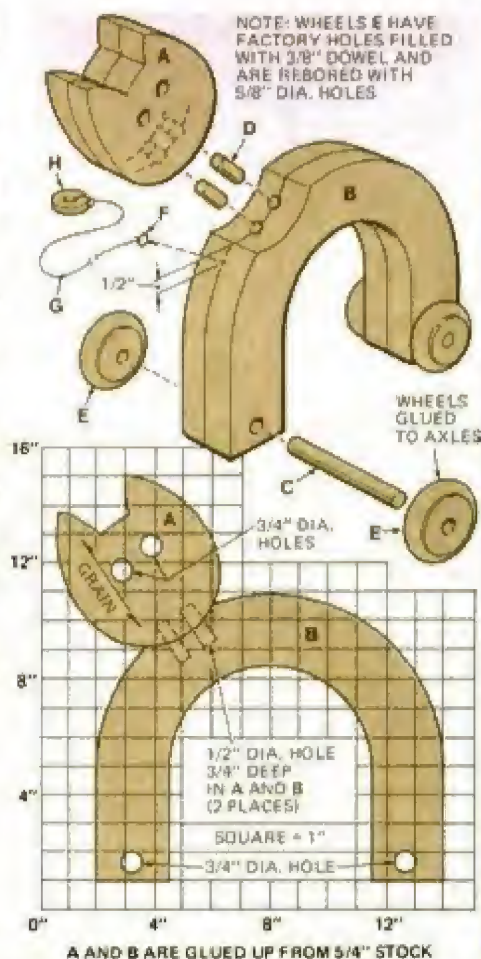
6. Seal all wooden parts with white shellac, thinned 50 percent with denatured alcohol. Allow to dry. Next day, finish animal bodies with a satin-finish varnish. Let them dry.

7. Install screw-eye, add pull cord and wheel button. Glue one wheel to the end of each axle and insert dowel into axle hole. Add the second wheel.

8. On the dog, add ears. Set the toy aside to dry for at least 24 hours before gift-wrapping it.

MATERIALS LIST—CAT PULL TOY

Key	No.	Size and description
A	2	1/4 x 6 x 6"
B	2	1/4 x 10 x 12"
C	2	1/4"-dia. x 3/8" dowel
D	2	1/2"-dia. x 1/4" dowel
E	4	3"-dia. wheel, Love-Built WP-19
F	1	No. 10 screw-eye
G	1	34" drapery cord
H	1	1"-dia. wheel



9 Colonial spice box

Most Colonial spice boxes of this type are fashioned of pine. However, for sheer elegance, we constructed ours of maple.

1. Start by cutting all parts to size, as shown in the drawing. To make assembly easier, mark all pieces with code letters.

2. Use an ogee cutter in your router to shape the top and bottom edges as shown. Rout the back edges of the sides to receive the 1/4-in. plywood back.

3. Temporarily assemble the top, bottom, sides, center dividers and back to check for fit—and to make measurements for the drawers. Adjust the dimensions until you're satisfied with the fit and squareness of unit. Then disassemble.

4. Sand all parts smooth and reassemble the box, using glue and clamps to hold the case securely until the glue dries. The next day, bore holes and install screws as shown. Add dowel plugs. (Note: Since our box is made of maple, we made our own dowel plugs, using a plug cutter in the drill press and a scrap of maple.)

5. With the box assembled, the drawers can be built. First assemble them dry for a test fit, then permanently with glue and brads. Use match numbers for drawers. Each one should be fitted so it will be returned to its mating pigeon hole.

6. Check all parts for smoothness. Sand if necessary to bring the hardwood to a glass-like smoothness. Make a final dusting and wipe

(Please turn to page 174)

8 Pull train

Don't let the train's good looks fool you into thinking that building it is beyond your skills. The design is worked out so you have very little cutting to do; the shapes are created using standard lumberyard materials.

1. Start by gluing up stock for one engine, three cars and a caboose. Use white glue and clamp the parts overnight.

2. On cars to be rounded, cut the 3/4 x 1/4-in. edge rabbets along both top edges to receive the 1/4-in. quarter-round molding. Install the molding, using glue and 1-in. brads.

3. Cut parts for the engine and install them with glue and brads. Use masking tape to hold the various parts securely until the glue dries.

4. Locate and bore the 5/16-in. axle holes through the bodies. Sand all parts smooth, dust and wipe with a tack cloth.

5. Seal all wood parts with 3-lb.-cut white shellac thinned 50 percent with denatured alcohol. The next day lightly sand all parts with 180-grit sandpaper, dust, wipe with a tack cloth. Apply a second, unthinned coat of shellac to all parts which will be left natural.

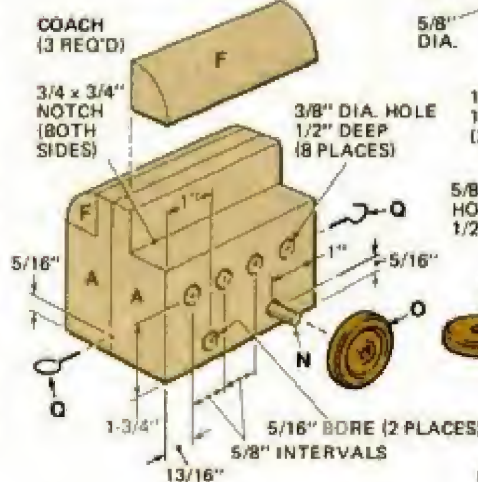
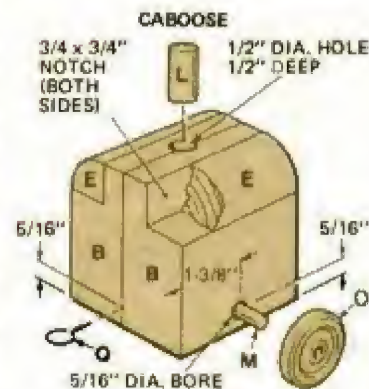
6. Paint the wheels and engine parts, using latex paint; use the color photos on pages 122 and 123 as your painting guide. When dry, the latex-painted parts can be coated with a thin coat of satin-finish varnish to achieve a pleasant sheen.

7. Glue one wheel on each axle (N) and insert axle into axle hole. Glue on second wheel.

8. Locate and bore pilot holes and install screw eyes and hooks. Cut the pull cord to a suitable length, add a wheel for sure gripping and wrap the gift.

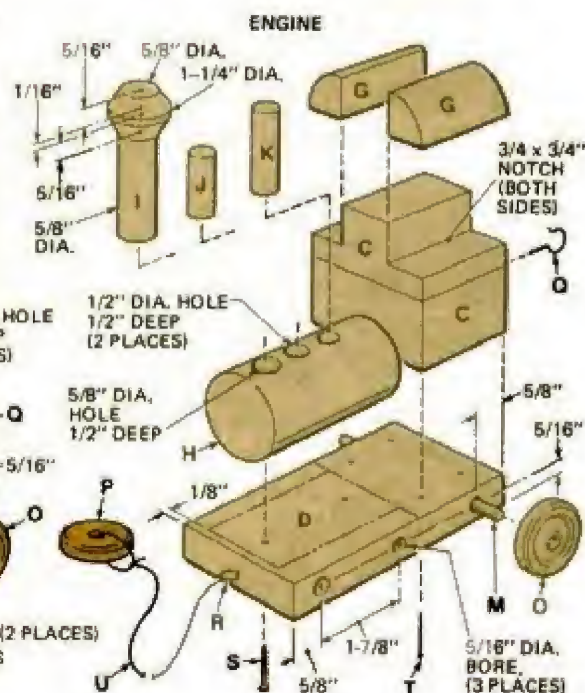
MATERIALS LIST—PULL TRAIN

Key	No.	Size and description
A	6	1 1/4 x 2 1/4 x 3 1/2" (2 each coach)
B	2	1 3/4 x 2 1/4 x 2 1/4"
C	2	1 3/4 x 2 x 2"
D	1	1/4 x 2 1/4 x 5"
E	2	3/4 x 1/4 x 2 1/4" quarter round



F	6	1/4 x 1/4 x 3 1/2" quarter round (2 each coach)
G	2	1/4 x 1/4 x 2" quarter round
H	1	1 1/4"-dia. x 2 1/4" closet pole
I	1	Smokestack, Love-Built STK-2
J	1	1/2"-dia. x 1 1/2" dowel
K	1	1/2"-dia. x 1 1/2" dowel
L	1	1/2"-dia. x 1/4" dowel
M	4	1/2"-dia. x 3 1/4" dowel (3-engine, 1 caboose)
N	6	1/2"-dia. x 3" dowel, 2 each coach
O	20	1 1/4"-dia. wheels, Love-Built No. W18
P	1	1"-dia. wheel, Love-Built, No. W15
Q	4 sets	No. 10 screw eye & hooks
R	1	No. 10 screw eye
S	2	1" No. 8 ft screw
T	4	1 1/4" No. 18 brads

Misc.: 34" drapery cord, white glue, sandpaper, shellac, paint.



If you've had it with hunting for a tool in a jumbled pile, consider one of these beauties to corral them.

There are two reasons for wanting a good toolbox. For most of us, sorting through a pile of tools to find the one we need is both frustrating and time consuming. It is also a rather unhappy experience to come across an expensive, edged tool that is badly nicked simply because of the way it was stored. Since you may have a lot more money invested in tools than you realize, maybe now is the time to consider buying the toolbox that will let you keep your equipment shipshape.

Tool-storage units come in an astounding variety of sizes and shapes. A little shopping will reward you with a container that will make your tool storage and care a lot easier to manage.

You'll discover that prices range from under \$10 for a small toolbox to as much as \$600 for a tool cart loaded with drawers and compartments.

Size, number of extra features and construction quality have a direct bearing on price. But you may not have to spend a great deal to get what you need. For instance, if your tool collection is small and your mechanical activities are limited to minor repairs around your home or apartment, a small, inexpensive toolbox will serve you well.

On the other hand, if you're con-

Toolboxes that keep tools in top shape

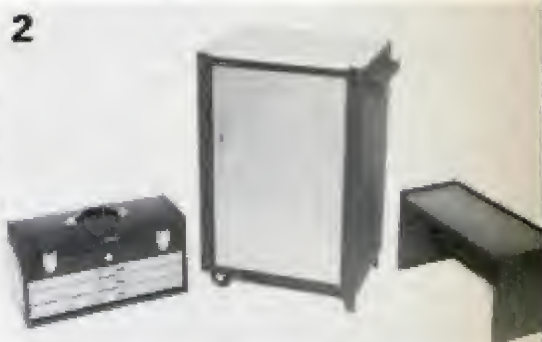


1 The Kennedy portable tool chest (\$52) sits atop a 20-in. roller cabinet (\$128).

2 Three-piece combo (\$85) from J.C. Penney has top chest, riser and work/storage unit. Two-wheeled base cabinet remains stationary or wheels where needed.

3 Here is a collection of some of the available toolboxes to choose from.

4 Perforations inside the cabinet door and cabinet side of this Penney unit permit hanging of tools neatly. The base cabinet has a pressed-wood work surface.





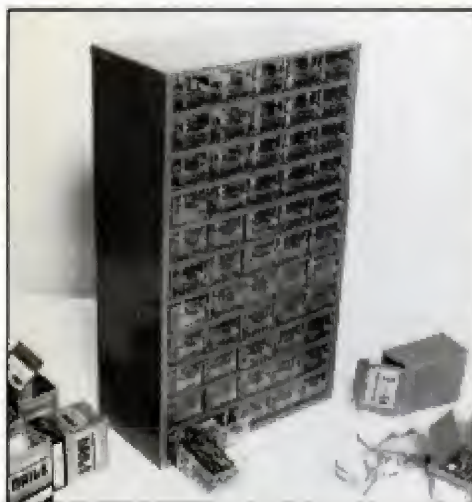
These modular units made by Kennedy are stackable for compact storage and easy access. The chest has drawers that lock automatically when the lid closes. Its partitioned top compartment includes a tote tray with a socket-set divider. Model 266 chest is \$153; Model 262 base is \$75.



The Master Chest priced at \$195 is made of solid walnut, tooled and finished similar to fine furniture. A fold-down front panel covers the drawers. Drawer bottoms are plated steel. The interior is lined in felt. Chest is from Garrett Wade, 302 Fifth Ave., New York, N.Y. 10001.



The two-drawer chest from Montgomery Ward is dimensioned to accommodate average-size tools. Overall size is 8½x10x20 in. When shut, the lid keeps the drawers closed so that you can transport it safely. The two-drawer chest, ticketed at \$27, comes with a padlock hasp.



This 50-drawer, see-through organizer from Montgomery Ward is great for storing small tools and miscellaneous parts. Plastic dividers and press-on identifying labels come with unit, which is priced at \$16.



The five-drawer Porta Box (\$40) from Sears is handy for storing miniature tools and small parts. Its drawers are lined with felt. A front retainer panel keeps them in place. The toolbox has a tumbler lock.



Sears carpenter's box (\$28) holds tools up to 29-in. long. A wood clip in the lid holds saws. Partitioned lift-out tray stores small items. Knock-out plug permits carrying a carpenter's square.

Swing-out trays on this cantilever toolbox keep every item immediately reachable. The model 1022 cantilever tool box is priced at \$58. Kennedy makes it.



stantly involved in home maintenance, shop projects or auto mechanics, your tools could easily number in the hundreds. In this case, one or more medium- or large-size boxes may be in order.

A large toolbox that's brim full may be too heavy to carry about with ease. And, if tools aren't well organized inside the box, it will still take time to find what you need. Thus, you may be better off buying two medium-size containers.

Chest-cabinet combinations

If you have the money, you can treat yourself to the luxury of a full-fledged mechanic or machinist tool-chest with felt-lined interior. Both can rest on rolling cabinets.

These units have plenty of strong drawers that permit you to organize tools in neat rows for quick and easy

The chest-cabinet combinations are of modular design with stack-up sections which make them flexible to use. The portable top box lifts off, the base chest becomes a bench, and the roller cabinet floats as needed.

However, if you definitely anticipate a growing tool collection, you may want to make all combination-toolbox purchases at one time. Many dealers offer up to 10-percent price reductions when the units are bought in combination.

Other features of a well-built box are lid joints that are constructed so they shed water, and water-shedding hinge cap strips—strips over the hinge to protect it from water. Also look for rust-resistant hardware; comfortable handles and grips; solidly supported cantilever swing-out trays; embossed or reinforced lids and bottoms; and full extension drawers for easy access to tools. For precision-tool storage, a felt-lined box is recommended.

(Please turn to page 156)



Features to consider



NOVEMBER 1979 131

Build PM's tool chest for a master craftsman

The original is owned by carpenter Patrick Murphy—with his help we duplicated it down to the last detail

by David Warren



Compact tool chest made from cherry wood looks like a museum showpiece, yet it's durable enough to withstand the daily routine of a professional carpenter. For handling ease, it's actually two boxes.

1 Two halves of chest bolt together for storage. Aluminum angle inside lower half is drilled and tapped to accept bolts.

2 Grooved and slotted separators keep saws from jostling inside chest lid. T-shaped retainer pulls forward to allow saws to be removed.



One of the quickest ways to judge the skill and ingenuity of a craftsman is to take a look at the condition of his tools—and how they're stored. There's no doubt that Patrick Murphy, builder of the prototype for this tool chest, is a top-notch finish carpenter. Well-organized hand tool compartments that allow easy access, wood construction that absorbs moisture and protects tools from rust, and details like drawer stops and locks reflect years of experience and pride in doing things well.

PM's reproduction was built by Rick Eickhoff with few changes from the original. You can adapt the design to suit your own wood-working needs. Even if you file the chest plans for now consider build-



3 Chests stack neatly. Recess in top of lower half (shown) accepts bottom of upper half. Dovetail corners add strength.

4 Even space under drawers has purpose: Clipboard, plans have niche on left; screw-in handle to unit top stows at right. Lower unit's retractable handle, drawer-locking mechanism fit behind drawer stile.



PM photos: George Ratkai and Matt Doherty
Design consultant: Patrick Murphy
Cabinetmaker: Richard Eickhoff

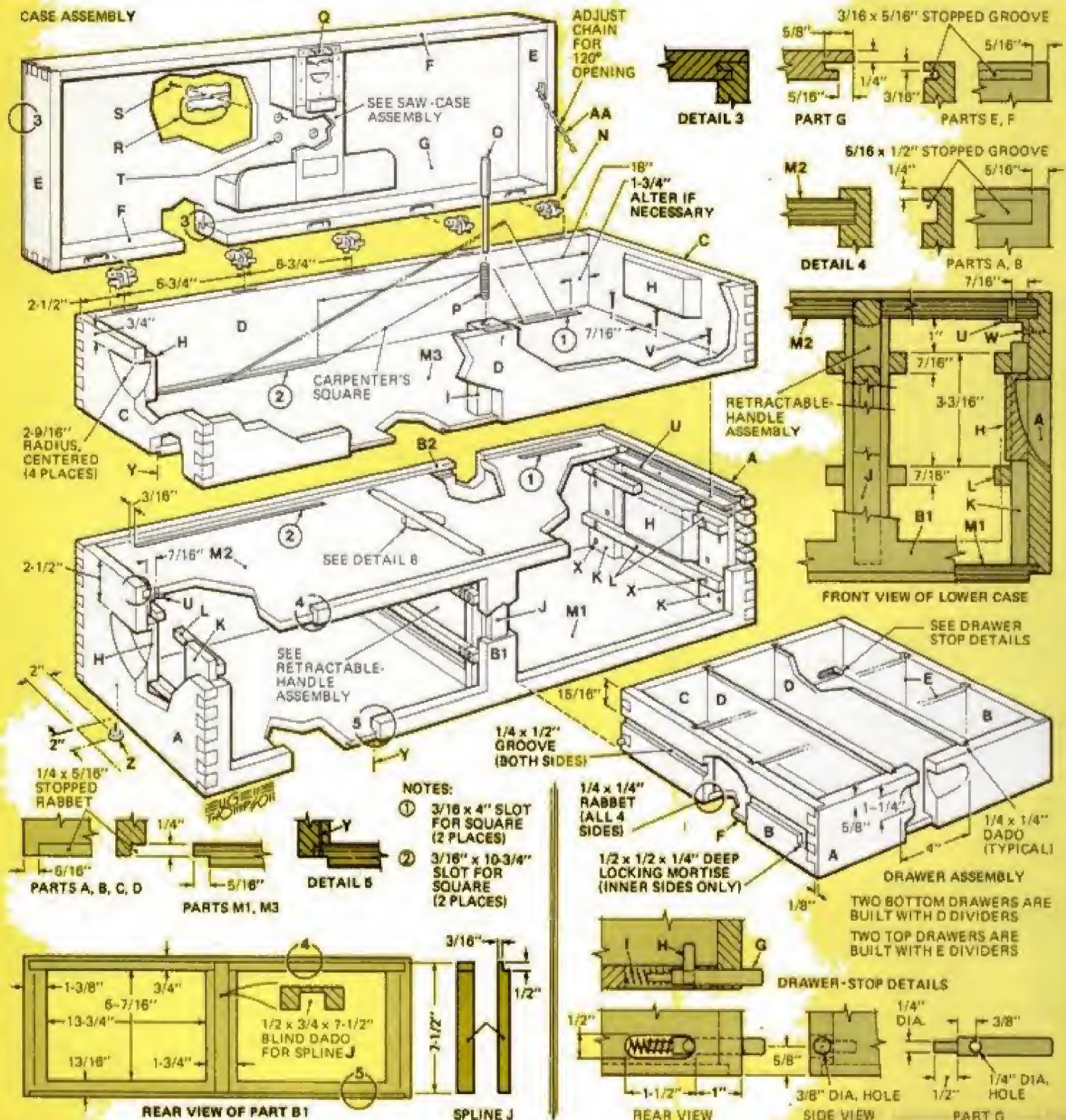


5 As lid closes, it depresses a pin which forces 1/2-in. sections of the drawer slides into mortises in the drawer sides.

6 Drawer backs have spring-loaded stops which prevent the drawers from being pulled out completely and spilling tools.

7 Oak dolly has heavy duty casters and makes toting chest over level surfaces easy.

8 Shallow recesses in dolly are sized to suit furniture glides that keep box from sliding off dolly during transport.



MATERIALS LIST—CHEST

Key	No.	Size and description (use)
A	2	1/2 x 8 x 12" cherry (lower case sides)*
B	2	1/2 x 8 x 32" cherry (lower case front, back)*
C	2	1/2 x 5 1/4 x 12" cherry (upper case sides)*
D	2	1/2 x 5 1/4 x 32" cherry (upper case front, back)*
E	2	1/2 x 2 3/4 x 12" cherry (lid sides)*
F	2	1/2 x 3 x 32" cherry (lid, front, back)*
G	1	1/2 x 12 x 32" cherry (lid top)*
H	4	1/2 x 2 1/2 x 6" cherry (side lift reinforcement)*
I	1	1/4 x 1 1/4 x 5" cherry (plunger guide)*
J	1	1/4 x 1/2 x 7 1/2" cherry (front spline)*
K	4	1/2 x 2 x 5 1/4" cherry (corner brace)*
L	4	1/2 x 1/2 x 10 1/4" cherry (outer drawer runner)*
M1	1	1/2 x 11 1/2 x 31 1/4" fir plywood (bottom)
M2	1	1/2 x 11 1/2 x 31 1/4" fir plywood (case panel)
M3	1	1/2 x 11 1/2 x 31 1/4" fir plywood (case bottom)
N	5	No. 101 Soss hinges*
O	1	1/4"-dia. x 6 1/4" steel rod
P	1	1/4"-o.d. x 3 1/4" spring
Q	1	1 1/2 x 2 1/2" No. K34 chest lock*
R	1	Handle for top of case
S	4	1/4-20 x 1/4" fh machine screw
T	4	1/4-20 Tee-nut (to mount handle)
U	2	1/2 x 1/2 x 10 1/4" aluminum angle

V	6	1/4-20 x 1 1/4" fh machine screw
W	8	1/2 x No. 8 fh wood screw
X	20	1" x No. 6 fh wood screw
Y	as reqd.	6d finishing nails.
Z	4	1/4"-dia. bottom furniture glides*
AA	as reqd.	Lid support chain, brackets and screws

Misc.: Oil-type wood finish such as Watco Danish oil finish,* white glue, ebony for initials,* inlay medallion.*

MATERIALS LIST—DRAWERS

A	4	1/2 x 3 1/2 x 13 1/2" cherry (front)
B	8	1/2 x 3 1/2 x 10 1/4" cherry (side)
C	4	1/2 x 3 1/2 x 13 1/2" cherry (back)
D	4	1/2 x 2 1/2 x 10 1/4" cherry plywood (divider)*
E	4	1/2 x 2 1/2 x 13 1/2" cherry plywood (divider)*
F	4	1/2 x 10 1/4 x 13 1/2" cherry plywood (bottom)*
G	8	1/4"-dia. x 2 1/2" dowel lock
H	8	1/4"-dia. x 1" dowel pin
I	8	1/4"-o.d. x 1" lock spring

MATERIALS LIST—SAWHOLDER

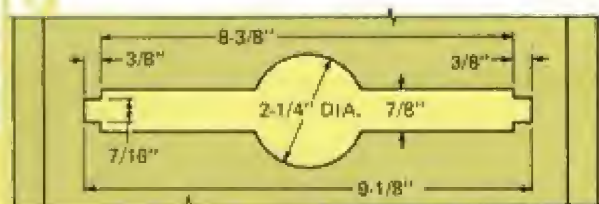
A	1	1 1/2 x 1 1/2 x 10" cherry (base retainer block)*
B	3	1/2 x 3 x 3 1/2" cherry (retainer block)*
C	1	1/2 x 3 x 5" cherry (vertical retainer)*
D	2	1/2 x 2 1/2 x 3 1/2" cherry (horizontal retainer)*
E	1	1/2 x 2 x 2 1/2" cherry (catch piece)*

F	1	1/4 x 1/4 x 2" cherry (catch piece latch)*
G	2	1/4 x 1/4 x 3 1/4" cherry (catch piece retainer)*
H	1	1/4"-dia. x 1/2" (spring dowel)
I	1	1/4"-o.d. x 1 1/2" (spring)
J	7	1/2" No. 5 fh wood screw
K	2	Spring-loaded hinge*

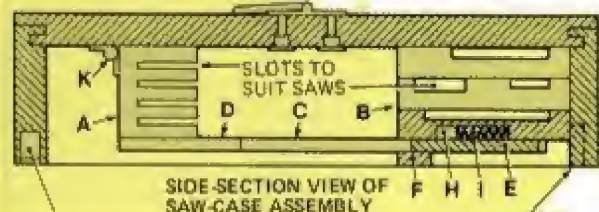
MATERIALS LIST—HANDLE

A	1	1 1/2 x 1 1/2 x 7" cherry (rear female guide)
B	1	1/2 x 1 1/2 x 9 1/2" cherry (base)
C	1	1/2 x 6 1/2 x 6 1/2" cherry (center section)
D	2	1/2 x 1 1/2 x 6 1/2" cherry (male guides)
E	1	1/2 x 1 1/2 x 7" cherry (front female guide)
F	1	1/2 x 1 1/2 x 6 1/2" cherry (locking mechanism)
G	4	1/2 x 1/2 x 1 1/2" cherry (runner locks)
H	4	1/2 x 1/2 x 10 1/4" cherry (center runners)
I	3	1/2 x 1 1/2" birch dowels
J	2	1/4"-dia. x 1 1/2" compression springs
K	12	1/4" No. 6 fh wood screw
L	4	1 1/4" No. 8 fh wood screw
M	1	1/4-20 x 4 1/4" carriage bolt
N	3	1/4-20 hex nut
O	2	1/4" washer

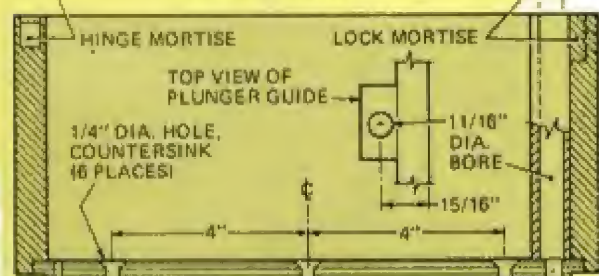
*Available from Craftsman Wood Service Co. See source list, page 166.



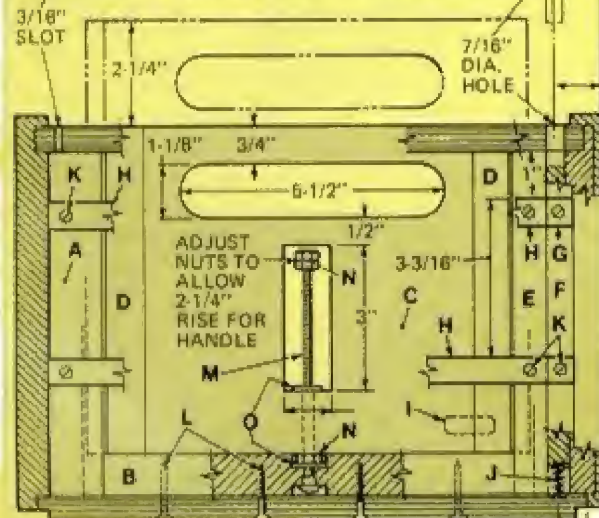
DETAIL 6 - TOP VIEW OF HANDLE CUTOUT



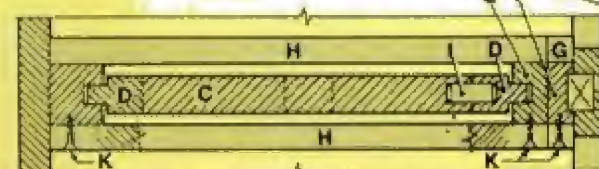
SIDE-SECTION VIEW OF SAW-CASE ASSEMBLY



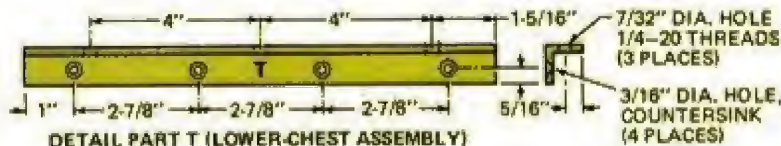
SIDE-SECTION VIEW OF UPPER CASE



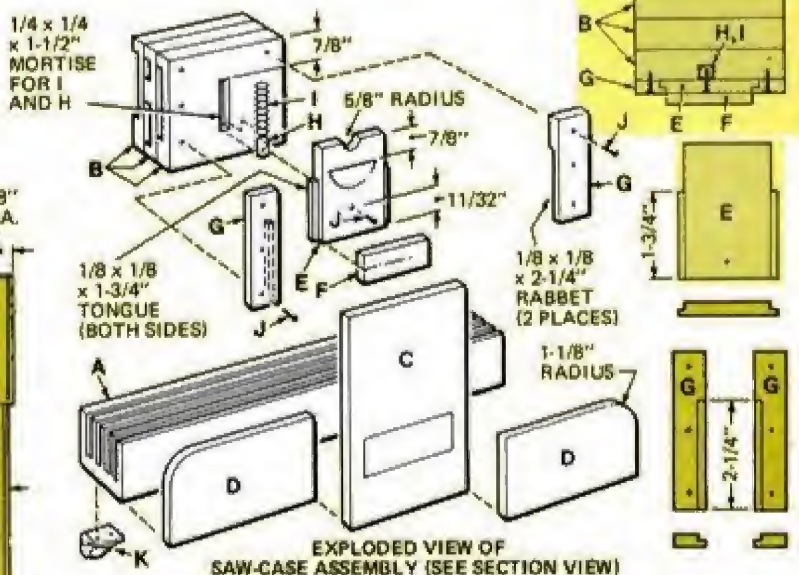
SIDE-SECTION VIEW OF HANDLE



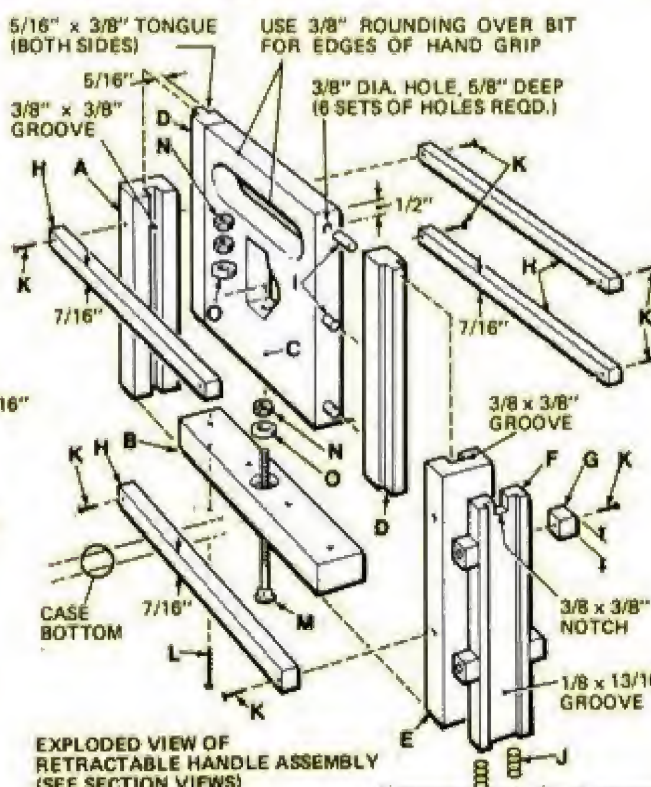
TOP-SECTION VIEW THROUGH HANDLE



DETAIL PART T (LOWER-CHEST ASSEMBLY)



EXPLODED VIEW OF SAW-CASE ASSEMBLY (SEE SECTION VIEW)



EXPLODED VIEW OF RETRACTABLE HANDLE ASSEMBLY (SEE SECTION VIEWS)

Build this bench for your

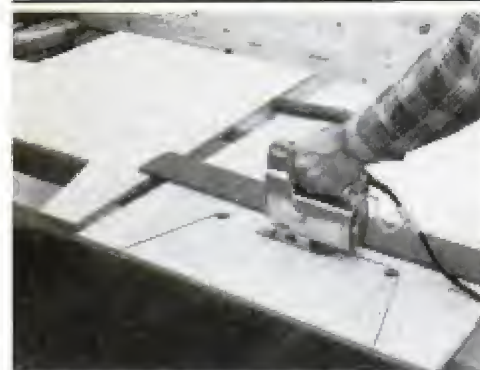
Cleverly designed table
makes your portable saw an
on-the-job shop tool.

by Emery J. Loiseleur

Get twice as much work from your portable circular saw by building this table that lets you convert it for use as a stationary unit. With the aid of an adjustable fence



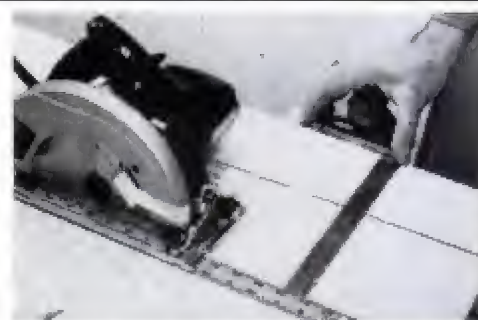
Completed table (above) boasts miter gauge, fence and a sawdust clean-out drawer. It can be easily carried to job site (right). Photos below show how to build it.

[illegible]

To make cutouts in bench parts, use sabre saw guided by tacked-down straightedge.



Use glue and 1½-in. finishing nails to assemble sides. Set all nails, fill holes.



Position saw accurately on table underside using a straightedge along side of blade. It should be parallel to table sides and perpendicular to front and back edges.



For long-wearing miter-gauge grooves, glue maple inserts (U) in table recesses. Use router, mortising bit to cut grooves.



Table inserts are used to reduce cutout width when sawing at various bevels.



Single-pole switch is connected between power-supply cord (GG) and pigtail (FF). Saw plugs into receptacle on pigtail.

portable circular saw

MATERIALS LIST—SAW TABLE

Key	No.	Size and description (use)
A	1	$\frac{1}{4}$ x 28 x 36" plywood (top)
B	1	$\frac{1}{4}$ x 5 $\frac{1}{2}$ x 18 $\frac{1}{2}$ " plywood (drawer face)
C	2	$\frac{1}{2}$ x 22 $\frac{1}{2}$ x 34" plywood (front, back)
D	2	$\frac{1}{2}$ x 24 $\frac{1}{2}$ x 34" plywood (side)
E	4	$\frac{1}{2}$ x 5 $\frac{1}{2}$ x 5 $\frac{1}{2}$ " plywood (corner blocks)
F	4	$\frac{1}{2}$ x 2 x 6" plywood (drawer supports)
G	2	$\frac{1}{2}$ x 6 x 23 $\frac{1}{2}$ " plywood (drawer supports)
H	1	$\frac{1}{4}$ x 16 $\frac{1}{2}$ x 23 $\frac{1}{2}$ " plywood (drawer bottom)
I	2	$\frac{3}{4}$ x 4 $\frac{1}{2}$ x 23 $\frac{1}{2}$ " plywood (drawer sides)
J	2	$\frac{3}{4}$ x 4 $\frac{1}{2}$ x 16 $\frac{1}{2}$ " plywood (drawer ends)
K	2	$\frac{1}{4}$ x 4 $\frac{1}{2}$ x 22 $\frac{1}{2}$ " plywood (sawdust-shield ends)
L	2	$\frac{1}{4}$ x 4 $\frac{1}{2}$ x 23 $\frac{1}{2}$ " plywood (sawdust-shield sides)
M	4	$\frac{1}{4}$ x 3 x 8 $\frac{1}{2}$ " lauan plywood (blade inserts)
N	4	1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ x 8" fir (glue blocks)
O	2	$\frac{1}{4}$ x $\frac{3}{4}$ x 22 $\frac{1}{2}$ " pine (cleats)
P	1	$\frac{1}{4}$ x $\frac{3}{4}$ x 23 $\frac{1}{2}$ " pine (cleat)
Q	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 4 $\frac{1}{2}$ " pine (cleat)
R	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 8" pine (cleat)
S	4	$\frac{1}{2}$ x $\frac{3}{4}$ x 23 $\frac{1}{2}$ " pine (drawer guide)

T	2	$\frac{1}{2}$ x $\frac{3}{4}$ x 23 $\frac{1}{2}$ " pine (drawer guide)
U	2	$\frac{3}{4}$ x 2 x 28" maple (tabletop inserts)
V	1	2 $\frac{1}{2}$ x 3 $\frac{1}{2}$ x 6" fir (outlet-box support block)
W	4	$\frac{1}{4}$ "-20 x 1 $\frac{1}{2}$ " fh machine screw and Teenut
X	2	$\frac{1}{4}$ "-dia. x 1" fh machine screw
Y	2	$\frac{3}{4}$ " No. 6 fh screw
Z	4	1" brad
AA	1	drawer pull
BB	1	outlet box
CC	2	$\frac{1}{2}$ " No. 8 fh screw
DD	2	cable clamp
EE	1	single-pole switch
FF	1	single receptacle and short length of No. 12 wire with ground
GG	1	6' or to suit, 3' lead wire and male plug
HH	1	switch plate
II	2	1 $\frac{1}{2}$ " No. 10 fh screw

Misc.: 1 $\frac{1}{2}$ " finishing nails and glue as required.

MATERIALS LIST—FENCE MITER GAUGE

Key	No.	Size and description (use)
A	1	$\frac{3}{4}$ x 5 x 8" plywood (miter quadrant)
B	1	$\frac{3}{4}$ x 2 $\frac{1}{2}$ x 10" plywood (miter-gauge face)
C	1	$\frac{3}{4}$ x 4 $\frac{1}{2}$ x 5 $\frac{1}{2}$ " plywood (fence head)

D	1	$\frac{3}{4}$ x 5 $\frac{1}{2}$ x 5 $\frac{1}{2}$ " plywood (fence head)
E	1	$\frac{3}{4}$ x 3 $\frac{1}{2}$ x 33 $\frac{1}{2}$ " plywood (fence face)
F	1	$\frac{3}{4}$ x 3 x 33 $\frac{1}{2}$ " plywood (fence back)
G	1	$\frac{3}{4}$ x 3 x 31 $\frac{1}{2}$ " plywood (fence bottom)
H	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 31 $\frac{1}{2}$ " pine (fence core)
I	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 31" pine (fence core)
J	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 3" pine (fence core)
K	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 1 $\frac{1}{2}$ " pine (fence core)
L	1	$\frac{3}{4}$ x 1 $\frac{1}{2}$ x 4 $\frac{1}{2}$ " pine (fence clamping toe)
M	1	$\frac{3}{4}$ x 1 $\frac{1}{2}$ x 4" pine (fence clamping cam)
N	1	$\frac{1}{4}$ "-20 x 34 $\frac{1}{2}$ " threaded rod (fence hardware)
O	1	$\frac{3}{4}$ " dia. x 1" steel rod (fence hardware)
P	1	$\frac{1}{16}$ " dia. x 1 $\frac{1}{2}$ " compression spring (fence)
Q	1	$\frac{1}{4}$ " I.D. rubber grommet (fence hardware)
R	2	$\frac{1}{4}$ "-20 nut
S	1	$\frac{1}{4}$ x 1 x 16" aluminum bar (miter-gauge hardware)
T	1	$\frac{1}{4}$ " dia. x 1" aluminum rivet (miter-gauge)
U	1	$\frac{1}{4}$ "-20 x 1 $\frac{1}{2}$ " threaded rod (miter-gauge)
V	1	$\frac{1}{4}$ " I.D., $\frac{3}{4}$ " O.D. flat washer (miter-gauge)
W	1	$\frac{1}{4}$ "-20 wingnut (miter-gauge hardware)
X	2	$\frac{3}{4}$ " no. 10 fh screw

Misc.: 1" brads and glue as required.

and miter gauge you make, this rig lets you make accurate rips and angled crosscuts quickly. It also frees both hands to let you manipulate the workpieces with greater ease and safety. When you have need for a portable saw, simply detach it from the table underside.

The on-off switch is mounted on the table front to let you control the saw from the operating position. Use a length of wire or electrician's tape wrapped around the saw's trigger and handle grip to secure it in the ON position.

The main design problem for any portable saw table is providing

enough clearance for the saw to tilt and cut bevels—without making the cutout opening for the blade and guard so wide that it would pose a

hazard when cutting small pieces of wood. The problem is solved here by making a series of four blade inserts

(Please turn to page 156)

Ready-made portable saw and router table



Steel saw table can be used with router, portable circular saw or sabre saw.

If you're not able to build a portable saw table and don't mind spending a few extra dollars, you can enjoy most of the same conveniences and advantages with a ready-made unit. The model we tried even lets you install a router or sabre saw in place of the circular saw to convert the table to a shaper or jig saw. Sturdy, heavy-gauge steel construction knocks down for easy storage and transporting.

The main disadvantage of the ready-made unit, when compared to the do-it-yourself version, is that its table area is a lot smaller, 18x22 in. compared to 28x36 in. The wide table-surface cutout, sized to allow saw guard and blade to tilt to cut bevels up to 45°, can be another drawback. It makes cutting small pieces difficult—even hazardous.

Both miter gauge and fence proved adequate. The gauge rides in a steel channel with minimal play. Printed inch scales at the front and back of the rip fence help to check the fence's alignment.

Models 665-B, and 666 (which include a clear Lexan blade guard) are marketed by Central Quality Industries Inc., Polo, Ill. 61064. Prices are about \$64 and \$68 respectively. Both are available through Ace Hardware dealers, J.C. Penney and Montgomery Ward stores.—Rosario Capolosto and Joseph Provey.



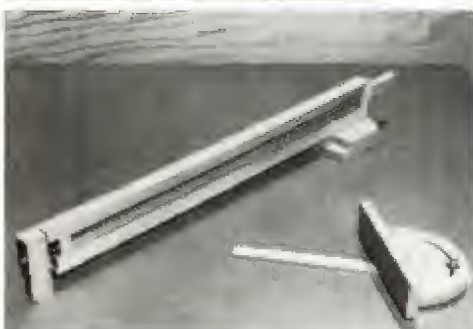
Knock-down unit assembles in minutes. A built-in switch box, also a receptacle for plugging in tool's power cord, receives power from grounded wall outlet.



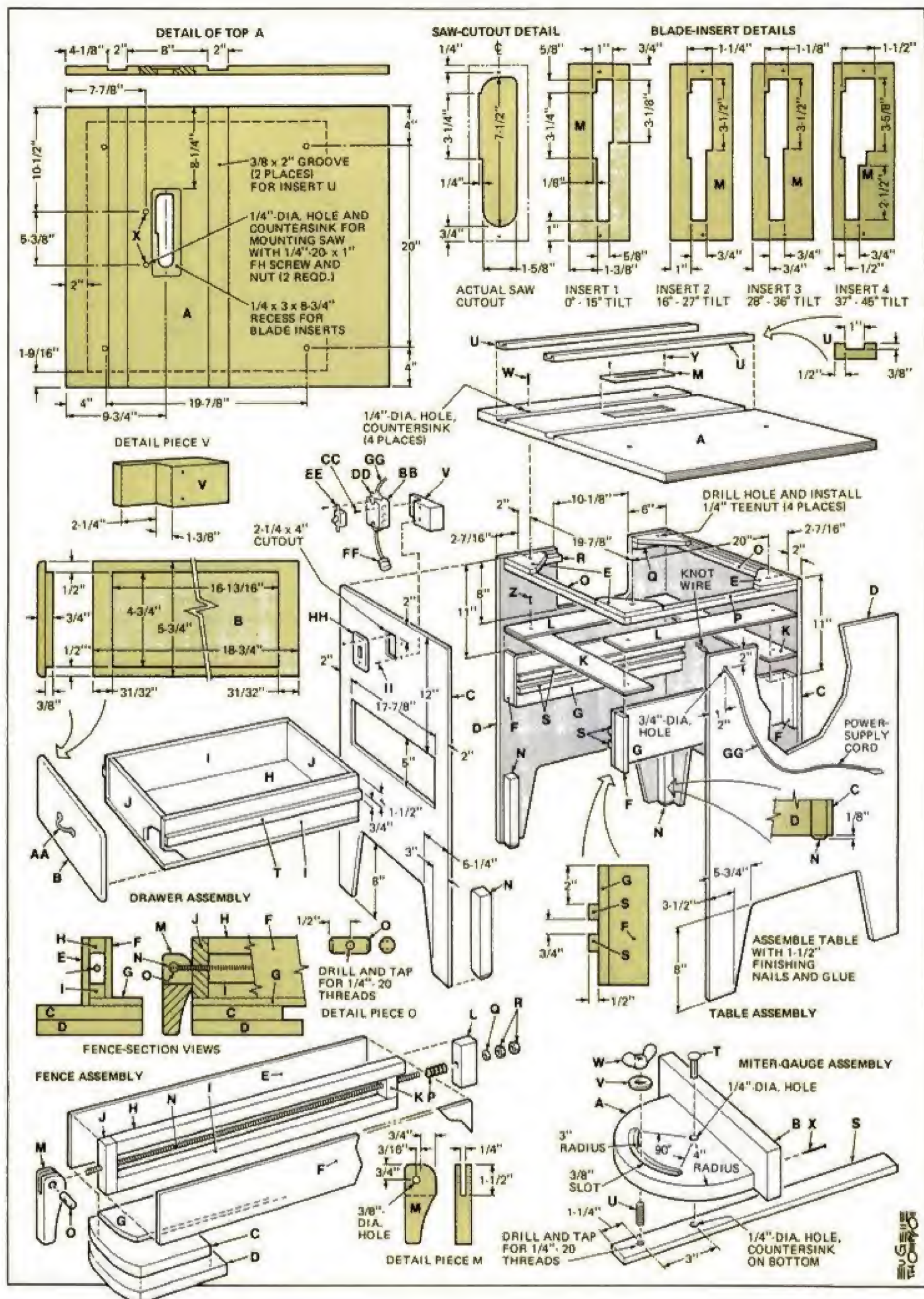
Variety of clamps permits mounting of almost any size or make saw.



Cut table insert recess using router and mortising bit. Wood strips act as guide.



Careful construction of fence (part E removed to show assembly) and miter gauge will assure accurate cuts later.



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Pays For Itself • R. S. Clark, Springfield, Ohio: "I bought a batch of walnut in the rough, and after planing it on the Belsaw I figured up the money I had saved. It was enough to pay for two-thirds the cost of the Planer. It really does a good job."

More Than Expected • Stephen Schultz, Orangeville, Penna.: "This machine pays for itself by making money out of scrap boards. It is a very well built machine and I confess it is more than I expected for the price. It does everything you say it will."

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JAY HEDDEN—Editor of WORKBENCH Magazine

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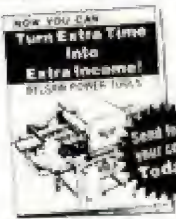
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Great Shop

A master craftsman's closet-sized workshop

By popular demand, we're bringing back PM's Great Shop series. For openers, we've got a beauty that belongs to a pro.

by Harry Wicks HOME AND SHOP EDITOR

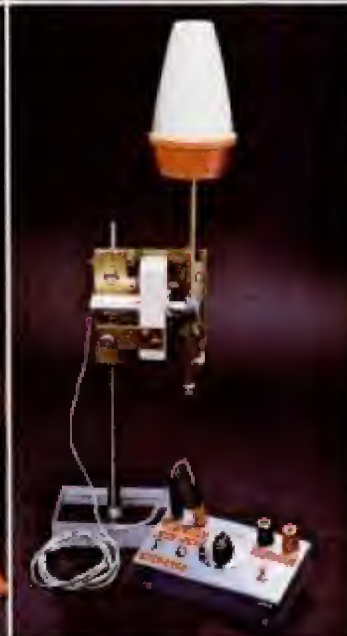
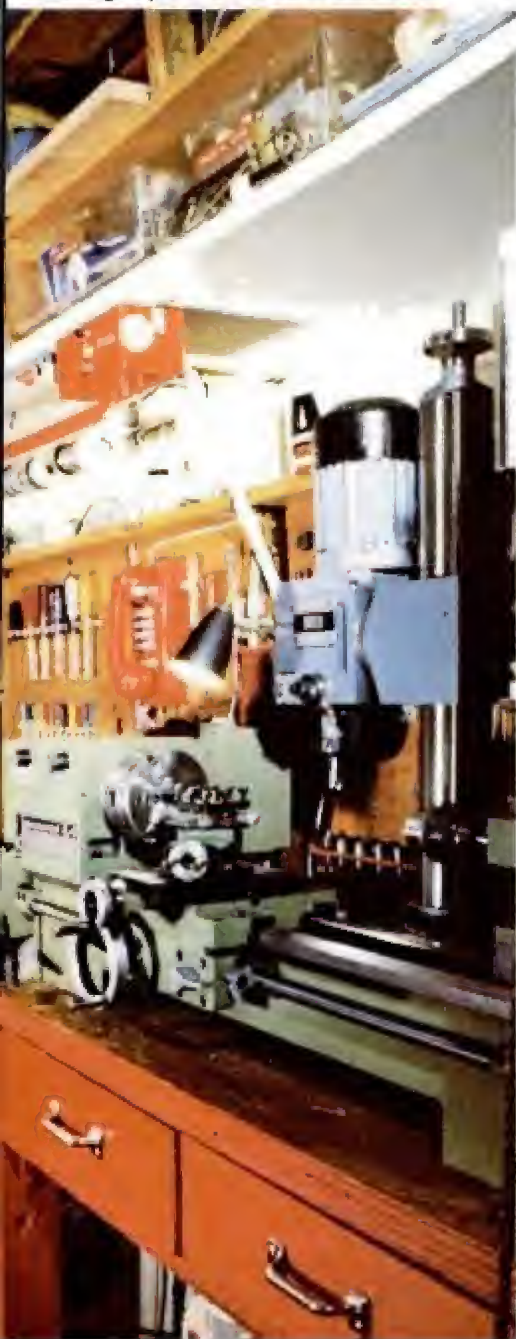
The Johnke shop is efficiently packed into what would be a closet for most. View above, looking to the left when standing in doorway, reveals drill press, saws and storage.



Pete Johnke (right) shows author clever device he created for a TV commercial.



Below: Looking right from doorway, is the metal lathe and milling machine—a tool that its owner swears by—neatly fitted in with storage space above and below it.



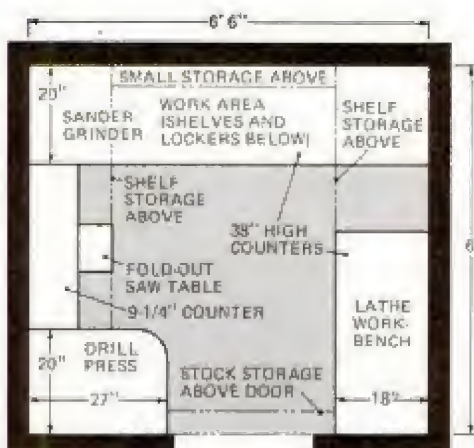
Creative projects from the Johnke workshop

1. Slowly revolving wristwatch—with no apparent means of support (top)—was created by Johnke for use in TV ad. Using wire that is 1/32nd as thick as human hair (center picture) he suspended the watch from one end and tied the other to electric motor apparatus he rigged (photo above). Under normal lighting, and photographed against black background, wire is "invisible," even to the camera.

2. Room freshener, which must be twisted open by hand in everyday use, had to be set up so that it seemed to open by

itself so viewers would understand its working principle (top). To create the illusion, a motor and custom rigging that obeys commands from his off-camera position at the control panel was set up by Johnke. Canister is affixed to motor with a small rod which is then hidden from camera lens with black material.

3. Another ingenious Johnke device: Toothpaste maker claimed its product does the work of two toothbrushes. To illustrate, he set up this device which aligns a pair of toothbrushes at the flick of a switch.



Dimensions shown are correct; this super shop is squeezed into 39 sq. ft. of space.

I met Pete Johnke one day six months ago as I was leaving the *Popular Mechanics* office for a lunch date. He had stopped in, he said, to get my opinion of a miniature bandsaw he had designed and built. Since I was already late for my meeting I told Johnke that his drawings looked fine but that I really couldn't give a fair appraisal of the tool from the plans alone. He agreed, adding that he would prefer a "hands on" inspection and asked if I would visit his "little workshop in Manhattan."

When I arrived a week later, Pete, as he prefers to be called, let me into the room that you see on these pages. I realized quickly that his shop would be an

PM photos: Julius Spedale

TASTE WINSTON LIGHTS

Best taste.
Low tar.

13 mg. "tar", 0.9 mg. nicotine av. per cigarette, FTC Report MAY '78.

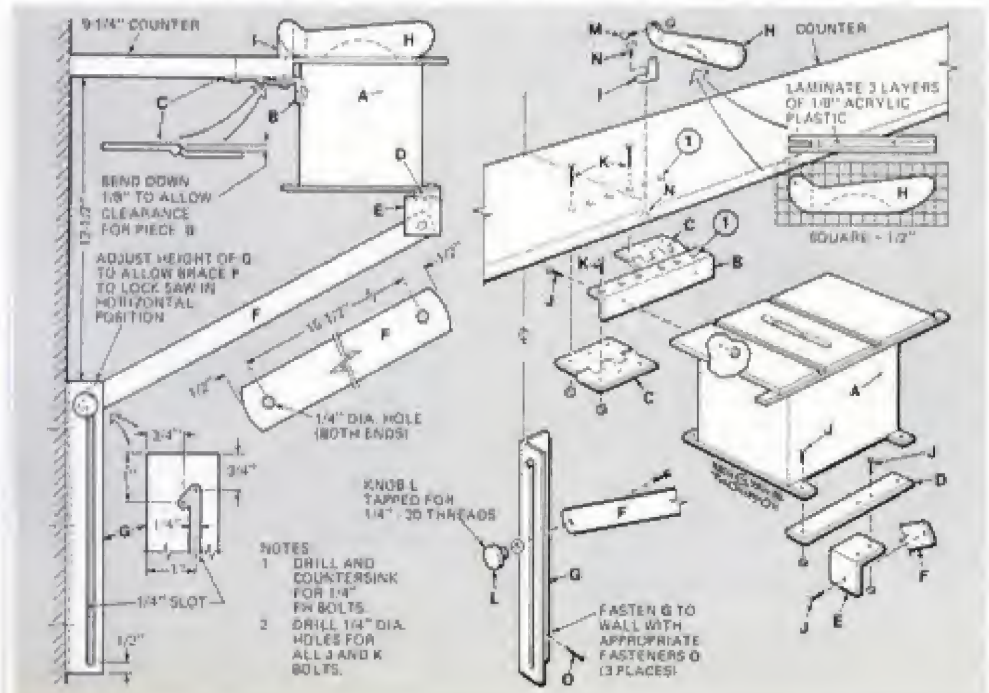
Warning: The Surgeon General Has Determined
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Born in Denmark, Pete Johnke began his career as a sailor. With his natural engineering abilities, he was, before long, the ship's wireless operator. He set up his first "workshop" on his first ship and, he says, "I have never been without a shop since." The shop you see on these pages is his twenty-second.

MATERIALS LIST—CIRCULAR SAW MOUNT

Key	Pcs.	Size and description	I	1	1/4 x 1 x 1 x 1/2" aluminum angle
A	1	4" Tilling Arbor Saw (Jamac, Box 2785, Springfield, Ill., 62708)	J	1	1/4"-20 hex bolt and locknut (length to suit)
B	1	1/4 x 1 x 1 x 8 1/4" aluminum angle	K	1	1/4"-20 flt. bolt and locknut (length to suit)
C	2	3 x 3" butt hinge	L	1	Knob, washer 1/4"-20 hex bolt
D	1	1/4 x 1 x 8 1/4" aluminum flat stock	M	1	1/2" No. 8 rh machine screw and nut
E	1	1/4 x 1 1/2 x 1 1/2 x 1 1/4" aluminum angle	N	1	1/2" No. 8 rh screw
F	1	1/4 x 1 x 16 1/2" aluminum flat stock	O	3	2" No. 10 flt. screws (into studs)
G	1	1/4 x 1 1/2 x 1 1/2 x 12" aluminum angle	Note: Johnnie has prepared printed plans for his original-design bandaw. To order a set, send \$5 to Johnnie Designs, Box 794, New York, N.Y. 10036. Price includes postage.		
H	1	1/4 x 1 1/2 x 6" Plexiglas			

Note: Johnke has prepared printed plans for his original-design bandsaw. To order a set, send \$5 to Johnke Designs, Box 784, New York, N.Y. 10036. Price includes postage.



Good storage in tight quarters



Since almost all of his projects are miniature, or close to it, Johnke can keep an incredible amount of materials stored in good-sized drawers beneath tools.



Clever storage stunt: Simple plastic trays, sold in 5- and 10-cent stores, are fitted into a Johnke-made wall cabinet.



Owner uses trays to hold small parts and materials such as pipe, tubing, fittings.



Additional storage is in the hallway, just outside this pint-sized workshop.



Here's a smart way—even in a large shop—to store a number of sanding sleeves.

years he left "to try it on my own," and has freelanced ever since.

"Ninety percent of my work is for television commercials," he estimates. "My task is to prepare products for the camera. If the product does something, I will make it do that something in a specified period of time." He stresses that he never makes a product do anything for a camera it doesn't do in real life.

For example, a toymaker recently asked Pete to make a particular tractor do its programmed functions so it could be filmed for a 60-second commercial. The computerized toy actually takes several minutes to perform a given number of maneuvers. He met the challenge and the TV spot ran last December.

"I think what I like best are the constant challenges of my business," Pete states. The special nature of his projects makes it often necessary that he create a workshop tool for a particular use. This led to the development of his bandsaw (which brought us together in the first place). I've used his saw, and can say it is the equal of any miniature tool I've ever handled—and better than most.

He is well aware of how good his miniature bandsaw is. He has patented the design and drawn plans which he hopes to sell. Considering the price tag, I'm sure many workshopppers will want to learn more about his creation. **PM**

Do you know a shop we should include in the *Popular Mechanics* Great Shop series? If so, send snapshots plus a description of shop and owner to Home and Shop Editor, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. If we agree, we'll visit the shop, photograph it and share it with PM readers.—H.W.



Johnke created these projects—three tables, oblong box, game board and wall sconce—when he had a large shop in the country. Though a gifted woodworker, his small shop has curtailed such activities.

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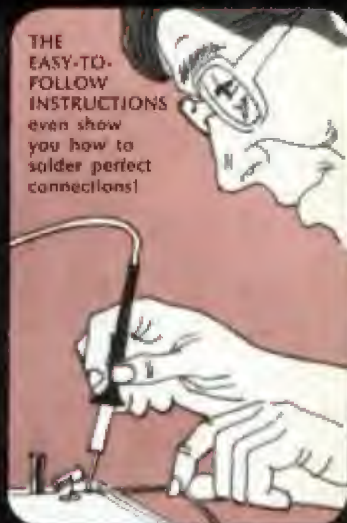
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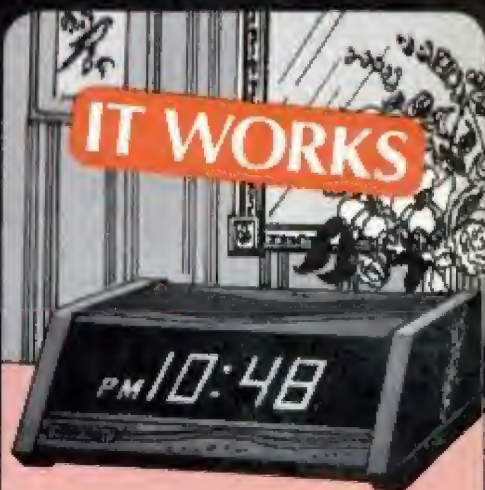


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DRIVING THE 1980 TOYOTAS

(Continued from page 106)

you'd expect. This understeer often demands quick correction which, if you're not used to front-wheel drive, can lead almost immediately to oversteer.

In other words, the car wants first to keep going straight. Then, when you crank in more lock, and especially if you don't add pressure on the accelerator (most people, in fact, take their foot off the gas pedal), the rear end swings out.

Now most drivers won't ever push their cars hard enough to have this happen on dry pavement, but it might show up on glare ice or in the wet. So be sure to familiarize yourself with any fwd car's handling characteristics before you run into an embarrassment.

The Tercel offers three transmission choices: a four-speed standard, an SR5 five-speed overdrive gearbox optional and a three-speed automatic likewise. I found the manual shift mechanism one of the best.

And here's the new Corolla

Changes in and outside the Corolla might look subtle, but they're extensive. Not only has the 1980 Corol-

la been fully rebodied, but it's also been upsized—contrary to the common trend.

It's 1.2 inches longer in wheelbase than its 1979 counterpart, with 1.7 inches more overall length, 1.6 inches greater width, and two inches added to the rear tread. All this pumping up reflects in more passenger space.

The Corolla's engine goes from 1588 cc in 1979 to 1770 cc in 1980. This boosts horsepower by five, along with 10 lb./ft. of added torque. No ratings for fuel economy as yet, though—not for any 1980 Toyota.

The new Corollas come in their usual tremendous variety of sedans, wagons and liftback body styles, with a sharp little sport coupe added this year. All bodies except the wagon share a new four-link, coil-spring rear suspension system that replaces the previous leaves (on all but the wagon).

Corolla seats have been redesigned for more lateral support, and I found them very comfortable. Again, there's that long track plus recliners. The Corolla has added insulation this year, and power steering is available for the first time in Deluxe and SR5 models. You can also get aluminum wheels on the

SR5 plus a sun/moonroof on liftbacks.

Toyota styling

Toyota tries very hard to style its cars for the American market. The current Celica, for example, was designed by Caltz, an American/Japanese team in southern California.

The overall design director for all Toyota cars is Mamoru Yaegashi. Yaegashi's staff styled the 1979 Coronas and 1980 Corollas, but not the Tercel, which tends to be more Hasegawa's baby—an engineer's design and perhaps a little retrograde alongside the other very clean and trendy Toyotas for 1980.

Toyota has no intention, though, of letting go its No. 1 import status in the United States. There's no doubt in Yaegashi's mind that styling cars for the American market helps to sell Toyotas all over the world. Thus, there's a fair chance the Tercel will show more Americanized lines in the near future.

The 104.1-inch-wheelbase Cressida, which Toyota hasn't really pushed in this country, is also due for a redesign. This work is going on in Japan, while Caltz busies itself with trim and color choices tailored to American tastes.

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DRIVING THE 1980 DATSUNS

(Continued from page 107)

controls are simple to decipher and operate, the four-speaker stereo's single-stick balance control is fun to play with, and one other nicety is the standard-equipment center console with built-in storage box and armrest. Our only negative impression, in fact, comes from the steering wheel, which has a nice, padded rim but inverted V-shaped spokes that make it impossible to assume the preferred "ten-and-two" hand position, and impossible to hook our thumbs over the spokes for spirited driving. As in the Z-car, a good after-market wheel will take care of this problem for those who care enough to spend the money.

Gone are the old 200-SX's narrow track and leaf-type rear springs. The new car features a four-link rear suspension with coils and the standard MacPherson struts in front, plus larger 14-inch tires and a much wider stance to reduce body roll and improve cornering performance. Steering is an excellent variable-ratio, rack-and-pinion unit with power assist (a German ZF design that's available in the SL version), and standard four-wheel disc brakes. The four-wheel clampers brought the 2600-pound car to a stop time after time during our test drive, with no pull and little fade.

Other standard features include radial tires; mag-style wheel covers; split, fold-down rear seatbacks in the hatchback; electric rear-window defroster; tinted glass all around; full cut-pile carpeting, extending into the door trim panels and cargo area; reclining front bucket seats with a "walk-in device" for easy rear-seat entry; and a right-side, sun-visor vanity mirror. Factory options for the base car are limited to airconditioning, three-speed automatic transmission, removable sun-roof and alloy wheels.

Available on both notchback (hardtop) and hatchback, the SL package adds a sunroof; multi-adjustable seat; four-speaker stereo with power antenna; graphic warning system already mentioned; cruise control (with automatic transmission only); variable-speed intermittent wipers; quartz digital clock with date; rear wiper/washer; raised white-letter tires for the hatchback (whitewalls for the hardtop); and a special courtesy-light system with a movable spotlight and variable-intensity overhead lamp. A very Detroit-like two-tone paint design is available on the SL hardtop.

We like the contemporary, wedgy

styling, but prefer the sexy hatchback to the more domestic-looking hardtop, which in profile reminds us most of Chrysler's new Cordoba and Dodge's Mirada. Datsun couldn't resist tacking on a pair of hokey hood scoops, but otherwise both new bodies are clean, modern and more European than Japanese in character—easily the best-looking Datsuns since the original 240-Z. Importantly, the body is 6.2 inches longer, 3.1 inches wider and a 0.4 inch higher than the old one, allowing additional interior room front and rear, as well as more cargo space. Prices are bound to be higher, but with all this and mid-20's mpg economy too, the 200-SX is finally a worthy Celica competitor in the import sport-coupe market.

While essentially unchanged underneath, Datsun's hot-selling mini-pickup line gets a complete restyling for 1980. Quad rectangular headlamps, wraparound front marker lights and a horizontal grille give a wider, broader-shouldered look outside, while a redesigned interior and new functional features and options enhance its overall appeal. Large, flip-out rear side windows are added to the unique King Cab model, two-tone paint is available and a special luxury GL 2+2 version is new. A single-handle tailgate release and inner tailgate panel are new, as are bright T-type tie-down hooks on the bed. Standard features on all but the base regular-bed model include tinted glass, center console, five-speed overdrive transmission and intermittent wipers. There's a tough-looking (factory-approved) "Boxer" dealer package available with custom stepside bed, multicolored striping and special wheels and tires.

The mid-range 510 series gets a handsome face-lift, a new and well designed four-door hatchback model, much-improved instrumentation (including tachometer) and a carbureted, 92-hp version of the same new 2.0-liter engine featured in the 200-SX. Called NAPS-Z (Nissan Air Pollution System), this engine has a cross-flow head with hemispherical combustion chambers and is said to be more fuel-efficient than the previous 2.0-liter four.

The 280-ZX sports car for 1980 features a new, optional T-hatch roof with removable smoked glass panels and along with Datsun's other lines (luxury 810, front-drive 310 and economy 210 series), benefits from a number of engineering and detail refinements for the new year. **RM**

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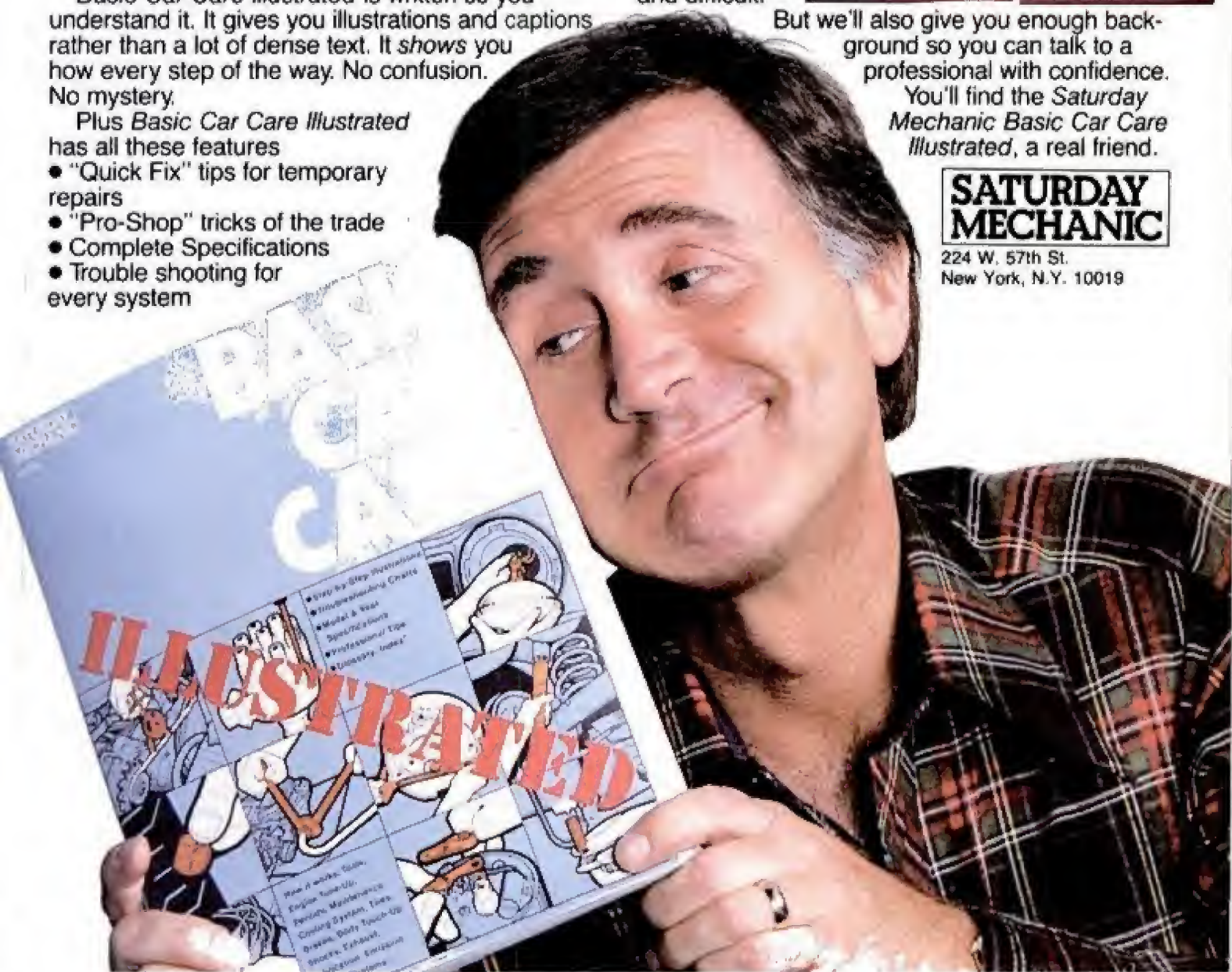


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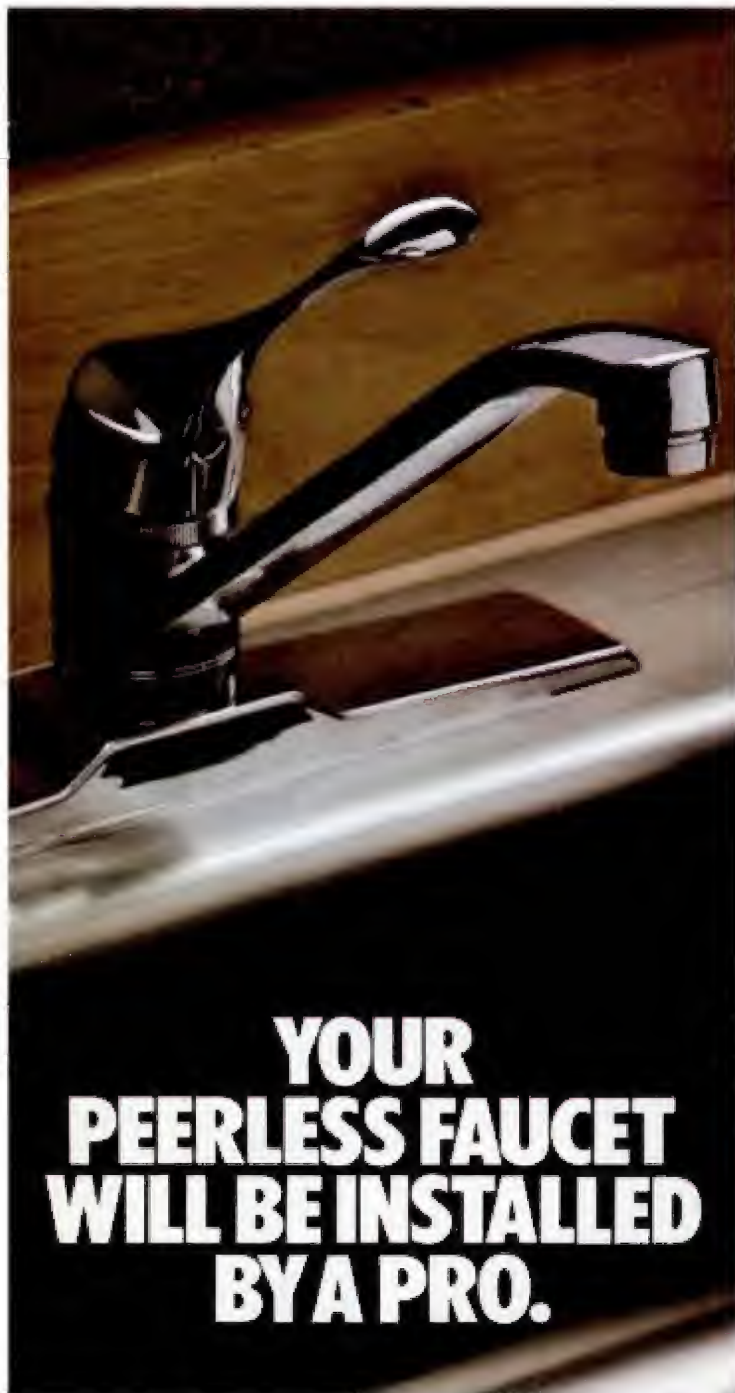


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hood and you'll see plenty of empty space, partly because some marketing experts believe that the bigger the box, the better it sells. Aside from eliminating this waste space, designers of the minis resorted to the latest microminiaturization methods developed for computers and spacecraft, and they also came up with some new tricks.

For example, the normally bulky power supply—transformer and filters—was shrunk to a fraction of its former size by using new pulse techniques that let these circuits run cooler. With less heat to dissipate from their surfaces these items could be made much smaller.

The top minimakers have already had great success with this type of sound equipment in Japan and Europe, where living space is usually tight. But with rising rents forcing more and more American city dwellers into smaller apartments, the minis may prove timely for this country, too. Even so, it's still an open question whether they can buck the old American notion that bigger is always better. A spokesman for Mitsubishi puts it this way: "We think audio fans everywhere are technically sophisticated and won't confuse size with quality."

We checked out five

The first batch of minis is just now sounding off in the stores, and PM checked out the five top brands: Technics, Mitsubishi, Sony, Toshiba

and Radio Shack. With the exception of Radio Shack, which offers a nifty and inexpensive minireceiver (Model STA-7), minis come as separate components—tuner, preamp, and power amp. (In the case of Sony, preamp and power amp are combined in a single unit.) The separate components of each brand are matched in length and width so they can be easily stacked for maximum space economy. Or, just the tuner and preamp may be placed on a shelf, while the usually bulkier power amp can be stashed out of sight—maybe under a bed or sofa.

Looking at these little boxes, you naturally wonder if these pygmies develop any real sonic muscle. So it comes as a surprise that Mitsubishi, the most powerful mini, develops 70 watts per channel—plenty for most home listening situations. Sony delivers 50 watts per channel (wpc), and Technics and Toshiba are rated at 40. Granted, this won't shake the rafters or register on the Richter scale, but with efficient speakers it fills even a big room with clean sound at realistic loudness levels. Even Radio Shack's STA-7, rated at a modest 10 wpc, sounds very good at moderate volume, but strains a bit if pushed to extreme loudness.

In any case, sheer power isn't what minis are all about. The important thing is that in all other aspects they more than hold their own against full-sized competition. Take

(Please turn to page 152)

MINIS AT A GLANCE

	Size (inches, HxWxD)	FM Sensitivity (microvolts)	Power (watts per channel)	Price	Remarks
Mitsubishi					
M-F01 FM stereo tuner	2½x10½x9½	2		\$340	Quartz-synthesizer tuning, FM only
M-A01 power amp	5½x10½x9½		70	500	LED output level meters
M-P01 preamp	2½x10½x9½			370	Mostly pushbutton controls
M-T01 cassette deck	5½x10½x9½			560	Front-loading
Technics					
ST-C01 AM/FM stereo tuner	2x11½x10	1.9		260	Active servolock tuning
SE-C01 power amp	2x11½x9½		40	360	LED power output indicators
SU C01 preamp	2x11½x9			260	High and low filters; balance and loudness controls
Toshiba					
F-15 FM stereo tuner	2x10x8½	1.9		360	FM only; quartz-synthesized touch-pad tuning
M-15 power amp	4½x10x8½		40	340	
C-15 preamp	4½x10x8½			300	Subsonic filter tone-control defeat
Sony					
ST-P7J FM stereo tuner	3½x8½x13	1.8		500	Quartz-locked frequency synthesis with pushbutton tuning
TA-P7F integrated amplifier	3½x8½x13		50	500	Tone controls behind hinged panel; extremely low distortion, 0.01% THD
Radio Shack					
System Seven STA-7 AM-FM stereo receiver	3½x16½x12	2.2	10	160	Remarkable performance for low-cost unit.

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NEW MINISTEEREO SETS (Continued from page 151)

the tuners, for instance. Sony, Mitsubishi and Toshiba all use digital synthesizer tuning circuits—a refinement still rare even on the big ones. It assures dead-eye accuracy in tuning even those faraway, hard-to-get FM stations. Since the digital synthesizer employs no variable tuning capacitor, but derives the tuning frequencies from quartz crystal vibrations processed by computer-type circuitry, it permits unconventional tuning methods.

On the Toshiba, for example, you punch in the station frequency you want on a touch pad, just as you would a telephone number. Sony provides preset tuning for up to eight of your favorite FM stations. You punch in the frequency of those stations after the scanning circuit reaches the right spot. After that, all you do is touch a single button, and the wanted station comes in.

Don't, by the way, confuse this with the primitive pushbutton tuning devices found on conventional car radios. Most of those operate as simple mechanical detents for the twirling tuning shaft, and the results are often hit-or-miss. Digital touch tuning, by contrast, pulls the exact frequency of a given station out of the synthesizer, thus assuring perfect, center-channel resonance between transmitter and receiver. Or, putting it differently, on a digital tuner it's simply impossible to mistune a station.

Buttons save space

Neither Sony nor Toshiba tuners have conventional scales—merely digital readouts flashing the station numbers. And, carrying digital design to its logical extreme, these tuners don't even have tuning knobs. Instead, you hold down one button to let the tuner scan upward toward higher frequencies—another button if you want to scan down. A brief jab at either button makes the scanner step up or down in small steps so you can hit any station accurately.

This arrangement saves space on the mini's tiny front panel, but many listeners may find this kind of tuning less convenient than twirling the knob and watching the pointer slide across the scale. Of course, with preset tuning of your favorite stations, there's less occasion for twirling, even if it could be done.

Technics and Mitsubishi use conventional tuning dials and knobs, but even here you'll find unusual refinements. Mitsubishi also has a quartz-controlled frequency synthesizer that locks onto each channel,

and Technics features a different tuning method called Active Servo-Lock. As the pointer on the scale approaches a station, the servolock grabs hold of the incoming frequency and automatically adjusts the local oscillator to "hold" the station. Incidentally, except for Radio Shack's receiver, all the minis use tiny LED indicators in place of conventional tuning meters.

With typical sensitivity ratings of 2 microvolts or better (a lower figure means higher sensitivity) these sophisticated tuners do extremely well even in difficult receiving locations. Only the far cheaper Radio Shack STA-7 has a less-sensitive, conventional tuner section with a simple signal-strength meter as the only tuning aid. In urban locations, near the transmitters, it holds FM stations quite steadily and sounds clean, but it is not at its best in fringe areas.

Fewer frills

When it comes to operating controls, the problem is where to put them. There just isn't room for all the knobs, slides and switches normally studding full-size front panels. So you'll find fewer frills, but nothing essential is left out, and everything is neatly arranged.

In that respect, Mitsubishi is out front. Figuring that rotary knobs are inefficient—because you need extra space to get your fingers around them—Mitsubishi banned all knobs from its preamp except for the volume control. All other functions are adjusted by rows of small pushbuttons, with tiny LEDs lighting up above the buttons so you can see the settings at a glance.

The Technics preamp has the most complete set of controls, including defeatable tone controls, high and low filters and loudness compensation. And Sony's integrated amplifier has probably the most impressive specification: an astoundingly low distortion rating of 0.01 percent THD. Other distortion ratings in this group typically lie between 0.02 and 0.05 percent, which is excellent, and even Radio Shack's 0.5-percent THD at full output is quite acceptable. In the Sony design, a cooling system employs fluid traveling through a wick inside a pipe to carry off excess heat.

Cassette decks, as you'd expect, are more difficult to miniaturize, but Mitsubishi managed even that. Their Model M-TO1 tape deck is small enough to stack with the other components in the line, although its height of nearly 10 inches makes it

taller than most minis. Despite its compactness, there has been no skimping on either features or performance. The closed loop, dual-capstan drive accounts for smooth tape travel, with flutter and wow measuring a mere 0.05 percent. The result is rock-steady sound. With high-quality tape the frequency response is said to reach up to 25 kHz.

The M-T01 has solenoid controls that respond to even the slightest touch; separate bias and equalization adjustments for normal, chrome, and ferrichrome tape; facilities for mixing a microphone input with the line input, plus an unusual feature called ASPS (Automatic Spacing Pause System). This automatically mutes the input for about three seconds after the end of a musical selection, so that a consistent stretch of silence separates the different "takes" on the tape.

No miniprices

The only thing that's nowhere small enough on most of these minis is the price (see chart on page 151). Only Radio Shack's STA-7 is an outstanding bargain, at \$160. Granted, the others are more powerful and more sophisticated in circuitry and features, but to us they seem overpriced. If you shop around, you can get equally good performance specs for a lot less among standard-size components. It shouldn't cost any more to make small components than any other kind, so it seems that we're asked to pay a premium for the sheer novelty of the minis. But as more come on the market (Aiwa has just announced its miniseries), prices will drop or be discounted.

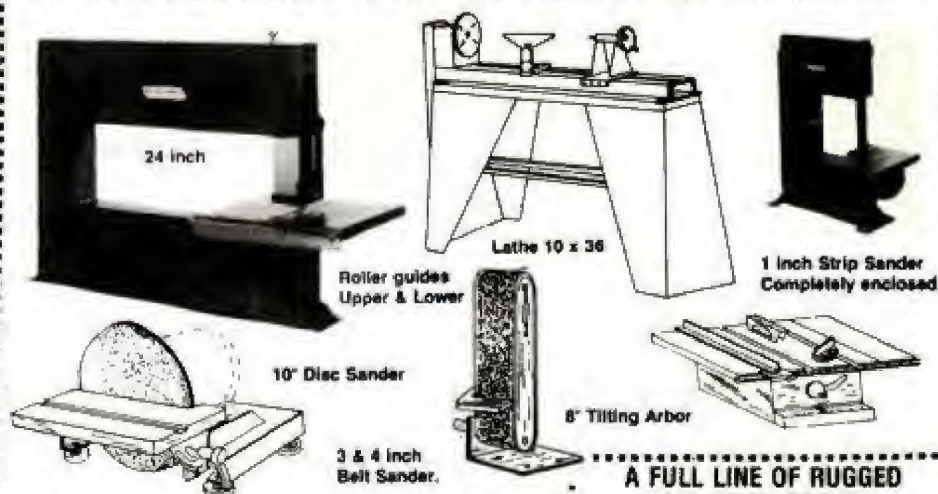
Finding suitably small speakers to go with these minis can be difficult. Lots of pint-size speakers have been introduced lately, and PM will evaluate them in a forthcoming article. Many are very good for their size, but few can do real justice to the sonic range of the minis.

For example, Radio Shack's STA-7 is usually sold as a complete system with a pair of their tiny Minimus 7 speakers. This combination sounds quite good, but the STA-7 would sound even better with a pair of efficient larger speakers. Likewise the other minis can do their best only with speakers capable of adequate bass, giving the sound the necessary depth and warmth.

If space is tight—the main reason for minis in the first place—you might consider small speakers with electronic-response tailoring, such as the KLH-3 (see page 134, Aug. '79). Like the minis themselves, they provide full and ample range despite pygmy dimensions.

FM

24 inch Band SAW CUTS TO CENTER OF 48 inches



DU-ER TOOLS — RUGGED ALL STEEL — BALL BEARING — EXTRA VERSATILITY

Du-er's 24 inch Band Saw gives the handyman the versatility of an industrial tool at a price he can afford, the quality that is demanded by industry. The Band Saw, one of the best cutting principals for wood, metal or plastic, has been limited in use because of the depth of throat. The B-24's Big throat and new drive feature gives longer blade life, cuts metal, wood or plastic.

Du-er tools are fabricated of Heavy Gauge Steel, 30 years experience developed new engineering features with accuracy, and ball bearings for added quality. Extra features created by manufacturing know how makes Du-er tools available at exceptionally low prices, yet no quality is sacrificed.

You can order direct from Factory where there is no Dealer represented . . . Free Information. F.O.B. factory

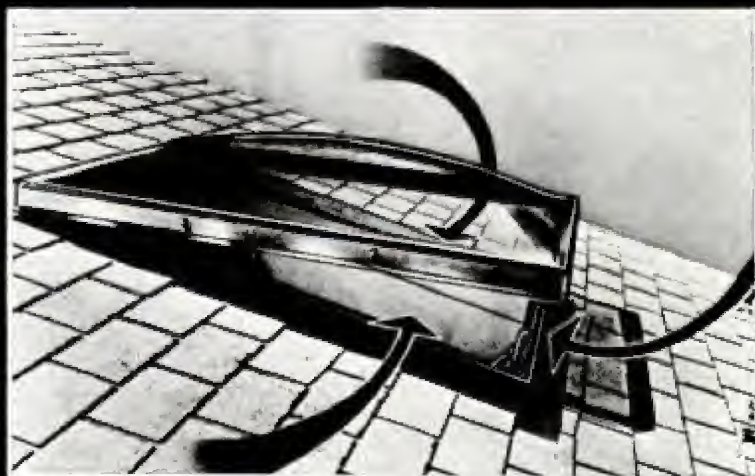
A FULL LINE OF RUGGED ALL STEEL TOOLS:

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VENTARAMA SKYLIGHT CORPORATION

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Light your bedroom clock for easy nighttime reading

If your bedside clock has been faithfully waking you up for years, don't trade it in for one of the electronic jobs just because it's hard to read when all the lights are out. Build this clock light/base, which will also serve as a convenient night light.

Our prototype was built from scraps of mahogany plywood and finished with shellac and lacquer. This can, of course, be changed to match your bedroom decor.

The extension cord we used has a molded rubber block and three pairs of slots to receive standard plug prongs—two on one side and one on the opposite side. The outlet block was clamped in place so the slots nearer its tip, on the side with two pairs of slots, are aligned with the front cutout.

The extension outlet could be installed flush with the back of the front panel (A). But routing a $\frac{1}{8}$ -in. recess (see drawing) will allow the night light prongs to be fully seated in the outlet.

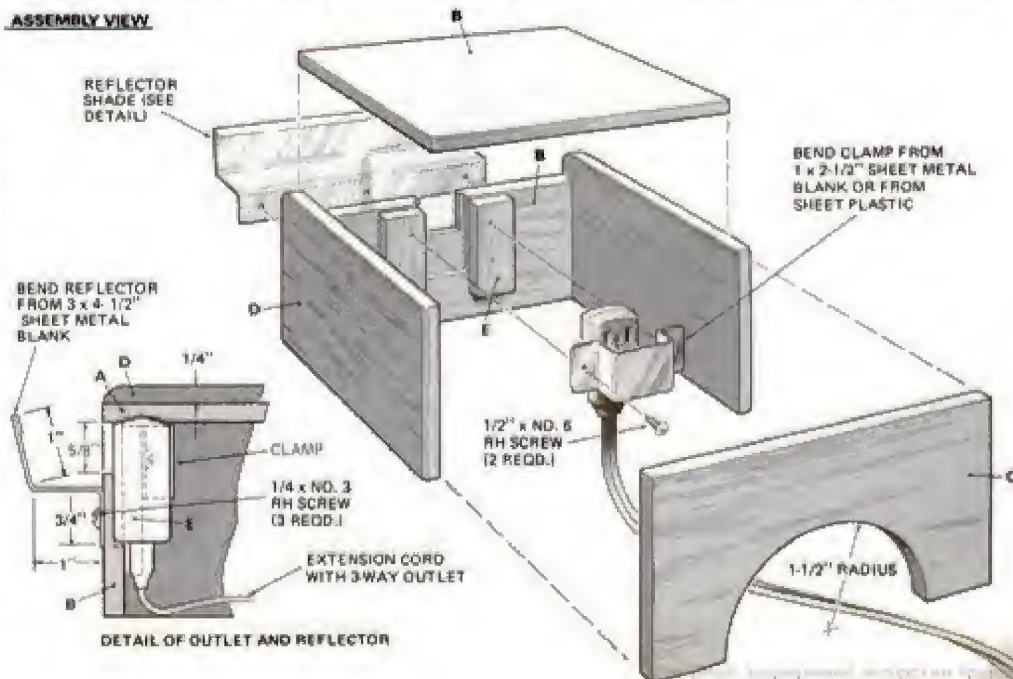
The platform's wooden parts (A through E) are assembled with white glue and brads. The top panel (A) was set below the top (D) edges to form a lip which works to keep the clock from slipping off the platform.

Note: Small neon bulbs found in some night lights produce a reddish glow adequate for reading a clock dial at a cost of only a few cents a year for electricity. Incandescent lights produce more light, but consume more current. Buy according to your needs.—Walter E. Burton

Illuminated clock platform makes in-the-dark time checks easy. It also serves as a night light to prevent you from stumbling about in the dark.



ASSEMBLY VIEW



MATERIALS LIST—CLOCK LIGHT

Key	Pcs.	Size and description
A	1	$\frac{1}{4}$ x $4\frac{1}{2}$ x 5" plywood
B	1	$\frac{1}{4}$ x $2\frac{1}{2}$ x 5" plywood
C	1	$\frac{1}{4}$ x 3 x 5" plywood
D	2	$\frac{1}{4}$ x 3 x $4\frac{1}{2}$ " plywood
E	2	$\frac{1}{4}$ x $\frac{1}{4}$ x 2" plywood

Misc.: Reflector shade bent from 3x4 $\frac{1}{2}$ " sheet metal blank or sheet plastic; clamp bent from 1x2 $\frac{1}{2}$ " metal blank or plastic; extension cord with three pairs of outlet slots; screws, glue and brads as required.

PM LOOKS AT BLIND NAILING TOOL



Quality-made miniature tool from Conover Woodcraft helps to revive the lost art of blind nailing on fine projects.



Here's a quick and easy way to raise a curl of wood so you can hide unsightly nailheads as the Old World craftsmen did. The Blind Nailer from Conover is well made and can be mastered in a relatively short time. It's \$21 plus postage from Conover Woodcraft Specialties Inc., 18125 Madison Rd., Parkman, Ohio 44080.—H.W.



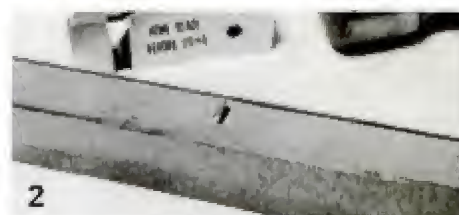
1. After setting nailer's blade depth, tool is tapped lightly with a hammer where nail is to be placed.

2. Curl is raised by tool's cutter.

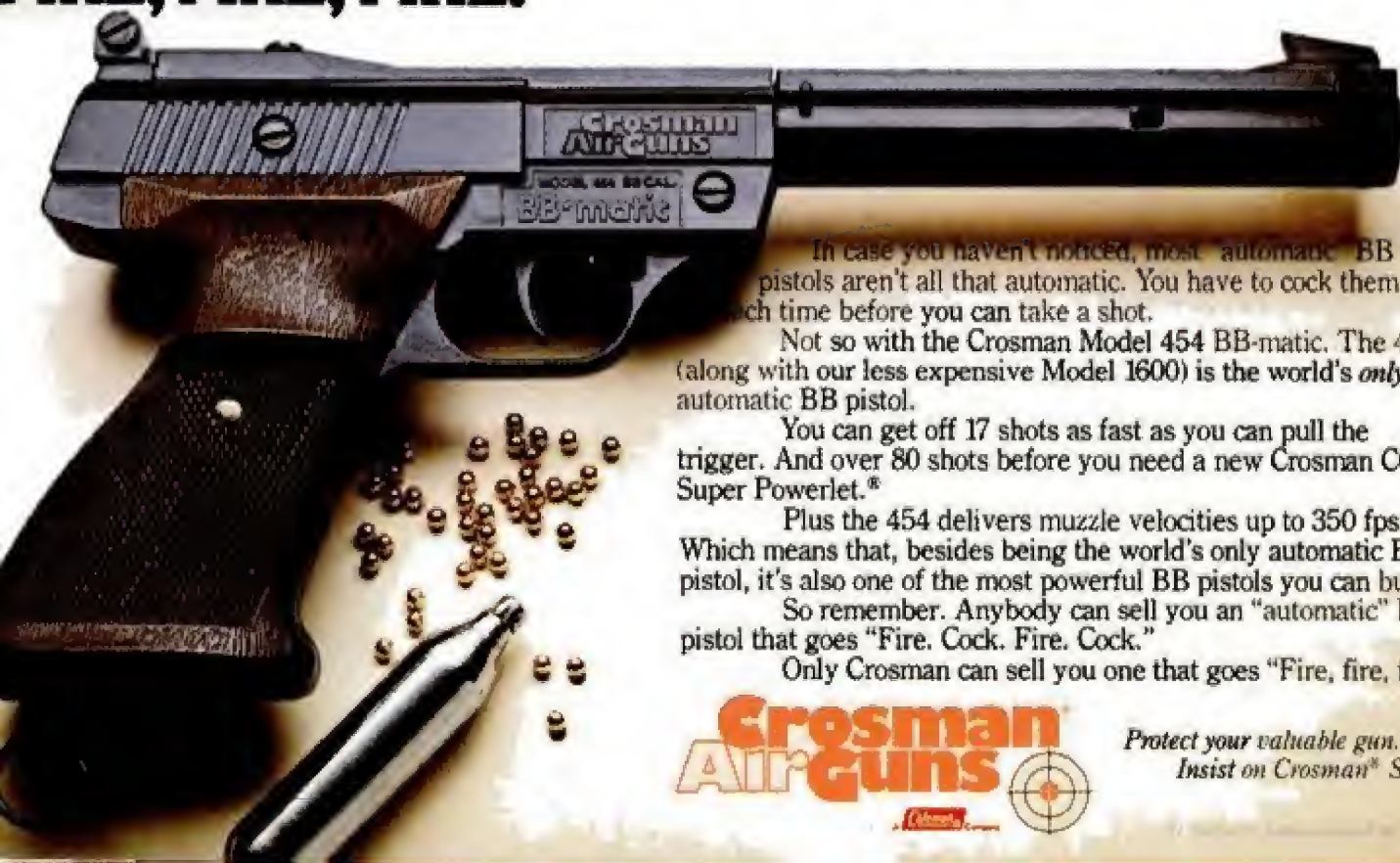
3. Finishing nail is driven, then carefully buried with a nailset.

4. Next, curl is glued back in place; author held it secure with masking tape until glue dried.

5. Hidden nail—inside circle—is just about invisible on unfinished wood.



**READY, AIM, FIRE, FIRE, FIRE, FIRE, FIRE, FIRE,
FIRE, FIRE, FIRE, FIRE, FIRE, FIRE, FIRE, FIRE,
FIRE, FIRE, FIRE.**



In case you haven't noticed, most "automatic" BB pistols aren't all that automatic. You have to cock them each time before you can take a shot.

Not so with the Crosman Model 454 BB-matic. The 454 (along with our less expensive Model 1600) is the world's *only* automatic BB pistol.

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So remember. Anybody can sell you an "automatic" BB pistol that goes "Fire. Cock. Fire. Cock."

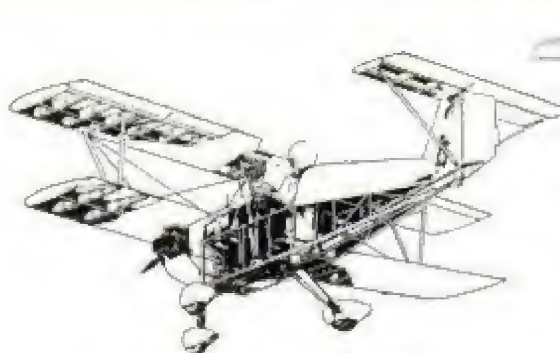
Only Crosman can sell you one that goes "Fire, fire, fire."

Crosman Air Guns



Protect your valuable gun.
Insist on Crosman® Super BBs.®

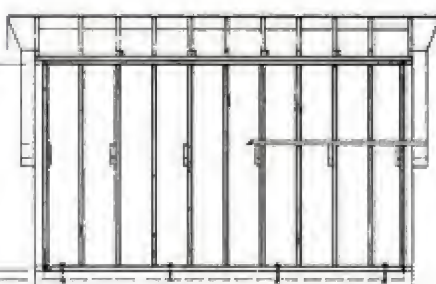
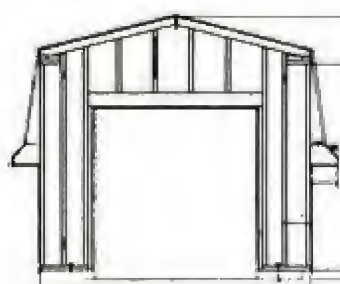
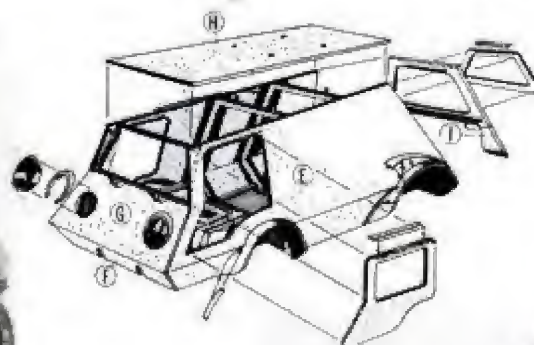
IN THE AIR, ON LAND



SCAMP



BOONIE BUG



DUTCH MINI-BARN

Popular Mechanics plans have been helping readers do the "impossible" for over 75 years. Here are just a few of the exciting PM plan projects.

SCAMP—A revolutionary all-metal, VW-powered acrobatic biplane that puts you in the air for less money than you'd think possible! With PM plans, man's dream of solo flight is easily attained.

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(Featured in Dec., 1973 issue)

BOONIE BUG—A dynamic, new vehicle concept! Constructed from a VW bus chassis, the 'Boonie' offers the go-anywhere ruggedness

of an ATV, the sleeping and camping facilities of an enclosed van and the smooth-riding quality of a conventional station wagon at highway speeds—all rolled into the slickest looking vehicle ever! Do-it-yourself with PM plans. **\$14.95**

(Featured in March, 1974 issue)

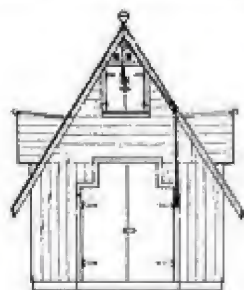
DUTCH MINI-BARN—You can erect our most popular backyard storage structure for under \$600. The roof design is somewhere between gambrel and mansard but it reminds us of Dutch colonial architecture. With 8 ft. of headroom inside and 10 ft. by 13½ ft. floor space it's fairly large although

it looks small. More than enough room for bicycles, lawn furniture, garden tools or use it as an office workshop or potting shed. Two sets of plans included, one for yourself and one for your building department. **\$5.95**

(Featured in August, 1972 issue)

STORYBOOK PLAYHOUSE—Put up a shed and the neighbors may hate you, but build this handsome little house and you'll be the hero of the neighborhood—especially among the small fry! This compact structure looks more like a storybook cottage than a toolhouse—but you can readily use it for storage. In fact, wide barn-type

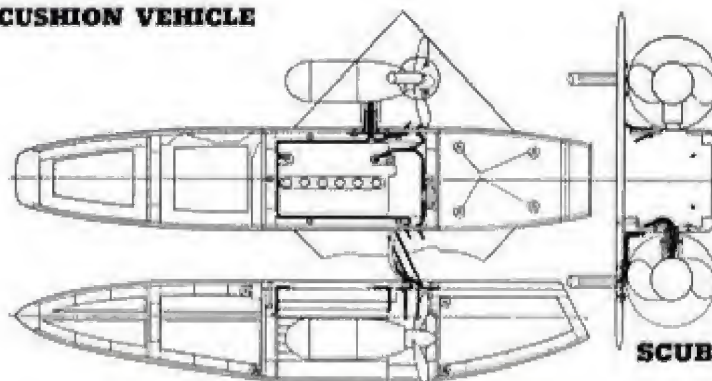
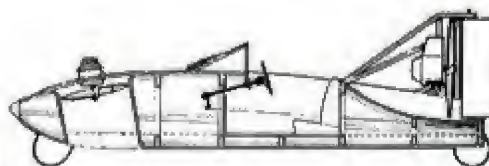
AND UNDER THE SEA



STORYBOOK PLAYHOUSE



LAND & WATER AIR CUSHION VEHICLE



SCUBA-TOW



doors in the back lead to a special tool-storage room walled off from the playrooms. You can hang a lot of garden tools inside and still provide plenty of play space. An extra set of plans is included for a building permit.

\$5.49

(Featured in July, 1973 issue)

LAND AND WATER AIR CUSHION VEHICLE—A go-anywhere air-prop craft, the exciting Cobra ACV skims land or sea at speeds up to 60MPH. 14 ft. long, with room for two passengers this innovative vehicle will cost you less than \$800 to build. A unique project for the serious do-it-your-

seller (caution must be paid in following all operating instructions). The joys of owning and operating this futuristic hover vehicle are truly inestimable.

\$12.95

(Featured in Sept., 1975 issue)

SCUBA-TOW—The electric-powered sea scooter that performs like costly commercial models! Motorized Scuba-Tow will pull you on or under the water for hours of effortless snorkeling or scuba diving. Rugged, light weight and dependable—you can build Scuba-Tow in a weekend or two from PM plans.

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(Featured in July, 1974 issue)

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PORTABLE CIRCULAR-SAW BENCH

(Continued from page 137)

of 1/4-in. plywood. Depending on the angle—or range of angles—required to cut a particular bevel, one of the four inserts is used. The odd configuration of the inserts is due to changing blade-guard positions at various blade heights and tilt combinations. See details on page 138.

PM's portable saw table was dimensioned for a J.C. Penney Model 1125 7 1/4-in. saw. If you have a different model, change inserts to suit. Make cardboard patterns to work out shapes.

Construction of the table is simple, but take care when making all cuts—especially when cutting the tabletop (A). It must be square if the unit is to function accurately.

The easiest way to build the table is to cut all parts and then preassemble the sawdust clean-out drawer supports (F, G and S). After assembling the sides, install drawer supports by nailing from the outside.

Four corner blocks (E) are used to anchor the tabletop to the sides. They should be temporarily nailed to the supporting cleats so mounting holes can be bored through top (A) and blocks (B) simultaneously. Remove the blocks to install Teenuts before gluing them permanently.

Aligning the saw with the table is critical. After making the cutout in A, locate the saw mounting holes to correspond to those provided on your saw shoe. If holes are not provided, you will have to drill them. Align the blade with the sides of the squared table; do not use the edge of the saw shoe. Then mark and bore holes for 1/4-20 fh machine screws. Countersink for screwheads to a depth slightly below the surface.

Note that the stepped patterns on the right sides of the inserts are important. They hold the guard partly raised and let it be pushed back as work is fed toward blade.

One fence-assembly step that may give you trouble is attaching the fence's cam lock (M) to the threaded rod (N). To attach, bore a hole in a length of 3/8-in. steel rod using a drill press and clamp to hold the work. Tap 1/4-in.-20 threads in the hole and cut the rod to size. Insert the piece (O) through holes in sides of cam lock and screw in the rod (H).

When the table is complete, the base may be painted. The top should be finished with two coats of satin varnish, lightly rubbed with 000 steel wool and coated with silicone lubricant or wax so accessories and workpieces slide easily.

KEEP TOOLS IN TOP SHAPE

(Continued from page 131)

find that price differences for the extras warrant consideration.

A cross section of the most widely marketed brands of tool storing units are shown on these pages. Included are products from Kennedy, J.C. Penney, Sears-Roebuck, Mont-



Tool Toter Box (\$12) by Kennedy is practical way to store hobby tools, supplies.



Odds 'n Ends Organizer (\$51) by Kennedy takes little shelf space, yet stores a large number of tools and small parts.



Kennedy's portable tool chest is on 20-in. roll cabinet for use in, out of doors.

gomery Ward and Garrett Wade. Each company offers a variety of units in a range of prices; Wade specializes in wood chests.

Consult the specific mail-order catalogs for detailed specs. Better yet, examine the actual items at the retail stores. Kennedy is a manufacturer whose products are stocked nationwide by quality hardware and tool-supply houses.

Capture and use the heat that normally goes up the chimney with a

Magic Heat

Saves on heating bills

Installs in minutes

Automatic thermostat control

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Built-in circulating fan

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Please Specify: Vent pipe diameter (6", 7", 8", 9", 10")

Type of fuel (coal, wood, oil, gas)

Add \$6.00 shipping for each one ordered.

Wisconsin residents add 4% sales tax

No Canadian Orders Please

Also Available: Fireplace heat reclaimer and wood & coal burning heaters.

FREE catalog with snowmobile, motorcycle, wood making, small engine parts, and other accessories.

Manufacturer's Supply

Box 157 Dept PM5 Dorchester, WI 54425

AMAZING PILOTLESS PLANES

(Continued from page 97)

was built and flown well before a manned version was tried.

The scissor-wing RPRV was a 900-pound, 25-foot-long aircraft made essentially of fiberglass/epoxy resin and powered by a 90-hp air-cooled engine. While an actual scissor-wing airliner would travel at speeds up to 750 mph, engineers learned a lot about the feasibility of the scissor wing by flying the RPRV at speeds of less than 100 mph. The scissor-wing RPRV, successfully flown in 1976 over the dry lake bed at Edwards AFB, could take off and land like a normal airplane, but by remote control. The ground-based pilot flew the RPRV using a TV picture transmitted from the plane, as well as telemetry information from the craft. Based on this success, NASA is now proceeding with the next step, a two seat, manned aircraft with a pivoting wing.

Future fighters will have to be much more maneuverable to survive dogfights of the 1980s and 1990s. To test advanced materials, flight controls, and aerodynamic concepts to meet future combat needs, two new RPRVs have been engaged in a joint NASA/USAF test program. These are called HiMAT aircraft, for Highly Maneuverable Aircraft Technology.

The HiMAT is about half the size of an actual fighter, weighing about 3000 pounds. It is powered by the same jet engine used in the Air Force's T-38 trainer. The HiMAT is dropped from a B-52 mother ship at altitudes of up to 45,000 feet and will be flown by a NASA pilot for missions of up to one hour. During these flights, the aircraft will be flown through maneuvers that result in sustained 8-G turns at 600 mph and 6-G turns at 800 mph. The HiMAT will land on skid-type landing gear on the dry lake bed at Edwards.

The pilot of the HiMAT has all the normal controls—stick, rudder pedals, instrumentation, throttle, plus a television screen that gives him the same view of the flight as if he were actually in the cockpit. Sensors and a TV camera transmit information to the ground-based computer which in turn digests it and sends the results to the pilot. The pilot's control inputs are immediately returned to the aircraft by way of the computer, for at such high speeds a moment of delay could spell disaster. Like the Firebee, control of the HiMAT can be taken over by an F-104 chase plane if contact is lost.

Aboard the HiMAT the actual movement of control surfaces and other components is accomplished

by a "fly-by-wire" control system. Small hydraulic actuators (pistons) move controls in response to electrical commands sent over wires from a central control station aboard the aircraft. "Fly-by-wire" control systems are also found in the latest USAF combat aircraft, like the F-16, and they result in more reliable and lighter-weight controls. In reality, "Fly-by-wire" is a sophisticated version of simple servos used in all R/C airplane models.

HiMAT aircraft is made in modular form so various sections can be removed and replaced to test many materials and aerodynamic shapes.

Grumman Aerospace Corp. is one aircraft company that has used scale models in a big way to check out new ideas and demonstrate new concepts to potential customers. Grumman's RPRVs, however, are much more akin to the R/C models you find in a hobby store than the larger RPRVs we have discussed so far. Grumman uses commercially available model aircraft engines and radio control gear. Their models weigh around 20 to 25 pounds.

Models test radical concepts

Grumman has been able to try out some concepts it would probably never have tried if it had to use full-scale, manned aircraft. One rather radical idea is called the nutcracker (see photo on page 93). On this vertical takeoff and landing craft, the fuselage is hinged about the midpoint of the plane so the tail section, which includes the engine, could fold down. In that position, thrust from the engine provides for vertical flight and hovering. For forward flight, the tail section is folded up so that it is in line with the nose and cockpit. The nutcracker design is *definitely* something you would want to fly in scale version before you plunged in a manned craft. Grumman has also used RPRVs to try out other unconventional ideas, such as a VSTOL airplane on which only the ducted engines tilt, and an aircraft with forward swept wings.

Models used by Grumman cost on the order of \$10,000 each, a small amount when you consider the millions that would have to go into building a manned version. Grumman also found it was too expensive to build these R/C models in their own shops using aerospace techniques and personnel, so they turned to a small company that specializes in R/C models. One thing Grumman has found from its work with models is that they are much more responsive than full-scale aircraft. Thus, if a unique model con-

(Please turn to page 160)

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Old-time Riverboat Playing Cards

Both of these decks are prettier than a painting, and so is the antique tin card case. Each card is a bit larger and thicker than normal—like those used on riverboats in the 1890's. There's a black and a green deck—both with an antique gold "distillery design." The face cards are reproduced from 100-year-old artwork. So it's a real unusual set of cards for the serious player. Twin deck in antique case: \$8.50. Postage included.

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Be YOUR OWN BOSS In a Fulltime Business Of Your Own...

As a fulltime business small engine repair offers many advantages. When you're the boss you work the hours you choose, there is never a worry over strikes or a layoff, and you earn year round profits repairing items such as chain saws, tillers, garden tractors, lawnmowers, mini-bikes, mopeds, go carts, edgers, power rakes, generators, paint sprayers, abrasive saws, snowblowers, snowmobiles... and more. There is no huge investment in equipment, no expensive inventory. You can work right out of your garage, basement or spare room... even a van makes a suitable mobile shop.

... Or Make Extra Cash Working Part Time

It's the ideal sparetime business too. In just evenings and weekends you can earn extra cash for a 'rainy day' or retirement fund, or use the cash you earn NOW for the 'extras' that you want. Many men begin working just their idle hours until their shop grows to the point they can switch to fulltime. When it's your business, you make the decisions and the choices are up to you.

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AMAZING PILOTLESS PLANES

(Continued from page 159)

cept can be safely flown, chances are the real thing will be quite practical and safe.

The use of Remotely Piloted Vehicles (RPVs) as part of military weapon systems also has great potential. The military services are seriously pursuing programs to develop RPVs because they are much less expensive than manned aircraft, their human pilots do not have to be risked on dangerous missions, and, since they are smaller than manned craft, the enemy has a more difficult time detecting them.

The RPV already proved its worth in the Vietnam conflict where modified Firebee drones were used on reconnaissance, electronic countermeasures and strike missions. For example, Firebees were launched from wing pylons on C-130 cargo aircraft to take photographs behind enemy lines. They eliminated the need for manned reconnaissance craft to fly through heavy ground fire and anti-aircraft missile defenses to obtain vital intelligence information.

RPV as Kamikaze

Future uses of RPVs in war are limited only by the imagination of military planners and the ingenuity of scientists and engineers. Already work is underway on RPVs that carry TV cameras and sensors that allow ground commanders to see the "enemy over the hill." Other RPVs will carry TV cameras and laser beam devices that can be used to designate targets for "smart" bombs and artillery-fired projectiles that home in on the laser beams. Using an RPV, target spotters do not have to expose themselves to enemy fire. Other RPVs equipped with bombs or mines could fly kamikaze missions to destroy targets ranging from radar sites to tanks.

Use on the RPV is not limited to the military. Already RPVs have been proposed for use in forest fire detection, traffic control, and for crime surveillance. NASA recently developed the Mini-Sniffer RPV which flies at extremely high altitudes to obtain data for pollution studies.

Many RPRVs are feasible today because of the recent advances in electronics, especially miniaturization. However, nothing can replace the manned prototype for proving a design is ready for production. They can only speed the development process, help eliminate early concepts that won't work, work out the bugs in other concepts and reduce the risks test pilots must take. **PM**

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FUEL FOR THE FUHRER

(Continued from page 103)

from coal was developed. Two Germans, Fischer and Tropsch, were successful in forcing mixtures of carbon monoxide and hydrogen, obtained from coal and water, to react in the presence of metal catalysts.

Different methods used

The Fischer-Tropsch process is used to liquefy coal that is low in hydrogen. This is the process used by South Africa, which has been fulfilling a significant portion of its liquid-fuel needs with coal since the 1950s.

The Bergius process is used in making synthetic liquid fuel from coal high in hydrogen. Most German coal is high in hydrogen. So is U.S. coal.

Since 1945, several other coal liquefaction processes have been developed. They are essentially similar in procedure to the Bergius method.

For the most part, Germany relied on the Bergius process for the production of synthetic gasoline. As Gill points out, "In 1936, Hitler saw the Bergius process as his key to conquest."

Hitler's four-year plan

He designated the chief of the German air force, Hermann Goering, as manager of a synthetic-fuel production industry. Its purpose was to make Germany energy self-sufficient for a four-year period, beginning in 1939.

Four years, Hitler felt, was all he needed to dominate territories rich in natural oil deposits. These territories were Romania and the Soviet Union, the two countries from which pre-war Germany obtained most of the natural petroleum that it required.

It was not by chance that in September, 1939, Hitler's armies struck east to capture Poland and give Germany a jumping-off point to attack its "OPEC." From this vantage point, he was able to coerce Romania into forming an alliance and to launch an ill-fated offensive against Russia.

Stalingrad forces shift

Before long, however, Hitler's plan to use synthetic liquid fuel until Romanian and Russian natural petroleum were brought under his control had to be altered. In November, 1942, the Russians stopped the Nazi army at Stalingrad, sending surviving German units retreating back across Russia. The Battle of

Stalingrad, one of the fiercest and most pivotal of World War II, was fought in paralyzingly bitter cold.

Concentrated Allied bombings of Romania's oil industry, especially the Ploesti oil fields in 1943, all but devastated this source of petroleum. Germany was forced now to rely almost completely on its synthetic liquid-fuel production.

The chart on page 103, derived from a captured German document, shows the rise of synthetic liquid-fuel production correlating with these events. Note how the production rate increased, reaching its peak in early 1944. Then, take a look at the sharp subsequent plunge. This drop coincides with Allied bombings of Germany's synthetic-fuel plants.

During a seven-year period, from January 1938 to March 1945, Germany produced approximately 130 million barrels of synthetic gasoline from coal, or 18.5 million barrels per year.

This fuel output accounted for 90 percent of Germany's required military aviation gasoline, and about 68 percent of the gasoline consumed by other military vehicles and the civilian population.

A place in U.S. energy plan

The amount does not compare, obviously, to the amount per day that President Carter's plan calls for: that is, reducing oil imports by 4.5 million barrels daily by the year 1990.

However, only 22 synthetic-fuel plants filled Germany's needs. There are many more oil refineries in the United States which, if converted to synthetic liquid-fuel production, could help to meet the 4.5 million-barrel-per-day goal. Furthermore, the new national plan that was announced by the President does not rely solely on coal liquefaction, but also will depend on conservation and other alternate fuels.

In any case, continued study of the German documents offers us a ready-made opportunity—an opportunity put into perspective for us by Dr. Irgolic:

"There has never been a similar opportunity in modern history to investigate the industrial synthetic fuel records of any country, much less those of a country with such advanced scientific and industrial expertise," he says. "Much of the knowledge contained in these records is available at a time when we so urgently need it." **PM**

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SNOWMOBILING

(Continued from page 113)

market for this North American fun invention, and high-altitude driving is a good trial for versatile operation. Kawasaki's line will include three Invader models: the one that set the 24-hour endurance record, one Intruder and three Drifters.

From Arctic Cat come the Lynx, Jag, Trail Cat, Panther, Pantera, El Tigre and junior Kitty Cat.

Bombardier's Ski-Doos will have



Options for Polaris Galaxy include 340- and 440-cc fan-cooled engines, electric start, adjustable handlebars and cleated track.



Yamaha SS440, with fan-cooled 437-cc power, has long-travel suspension, handlebar tripmeter, speedometer, tach, oil light.



Liquifire at top of John Deere line has a lighter chassis on 340 or 440 models, oil injection for 436-cc liquid-cooled engine.

three Citation and two Everest models with all-new designs, plus updated Elan, Elite, three Blizzards and Carry-Boose trailer. Moto-Ski features nine models.

John Deere's patrol machines at the Olympics include Liquifire, Sportfire, Trailfire and Spitfire units.

New from Polaris are TX-L Indy and Galaxy machines, plus six more.

All 10 Yamaha models will have their Autolube oil injection, a system more makes are copying. **PM**

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No gimmicks, no miracles.

No less remarkable than Triumph itself, is the technology that enabled us to build it.

The crux of it: Instead of searching for some yet unimagined answer, Lorillard scientists took a more sensible tack.

Why not, they said, take everything we've learned about cigarettes, and push that technology farther than we've ever pushed it before.

Delivering taste, limiting tar.

We found, for example, that combining two types of filter fiber produces the best combination of taste and draw.

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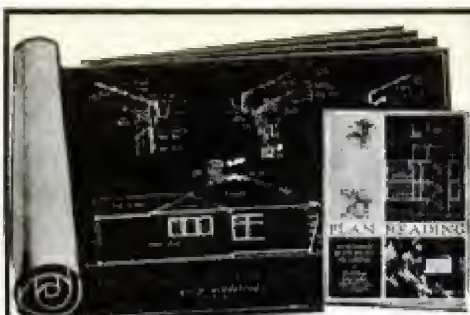


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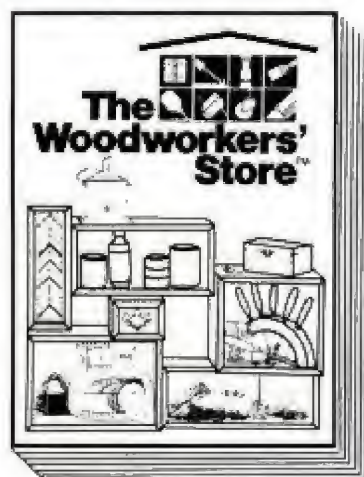
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BUILD PM'S TOOL CHEST

(Continued from page 134)

tical guide for the drawer-locking mechanism.

Cutouts for the drawers in part B1 weaken the dovetail corner joints. Use corner braces (K) to reinforce joints and for mounting drawer runners (L) in position.

Build drawers with stops, as shown in plans. Dovetail joinery is optional, of course. Carve pulls to match side lifts.

Retractable handle

Assemble and install the retractable handle components next. The carriage bolt (M), anchored in piece B, has two stop nuts (N) to allow the



Recessed chest lifts, drawer pulls can be carved with a gouge as shown. With this tool you can undercut top of concave area to create a finger grip. Sand smooth.



Cut mortises for Soss concealed hinges by boring a series of holes to proper depth using a bit with diameter equal to mortise width. Clean out waste with firmer chisel.

handle to be lifted high enough for your hand to grab it.

Installing lock mechanism

Make movable piece (F) and screw on pieces (G). (See exploded view of retractable handle assembly.) Bore recesses in the bottom for springs (J). Cut out plywood bottom (M1) to fit rabbet in bottom of lower chest half. Then rabbet the plywood edge. Next mark and bore recesses in the plywood to accept the springs.

To assemble, invert the lower chest half, insert the handle assembly and drawer locking slide (F). Glue M1 into the rabbet and also spread glue on the plywood where it contacts part B (see side section

(Please turn to page 168)

MATERIALS LIST—DOLLY

Key	No.	Size and description (use)
A	2	¾ x 3½ x 32½" oak (long rails)
B	2	¾ x 4½ x 12½" oak (short rails)
C	4	2" rubber-wheel casters, mounting hardware*
D	2	½ x 1 x 4" flat cold-rolled steel (caster locks)
E	12	¼-20 x 2" fh machine screws
F	2	¼-20 x 2½" fh machine screws
G	2	¼-20 x 3" fh machine screws
H	20	¼-20 hex nuts
I	1	¼" x 36" nylon rope

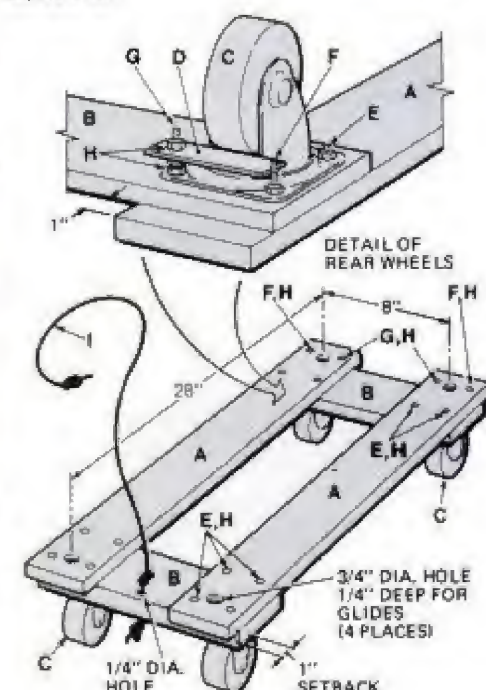
*Can be mail-ordered from Craftsman Wood Service Co. (See suppliers list).



Once upper chest is assembled, saw lid free. Use table-saw fence to guide cut.



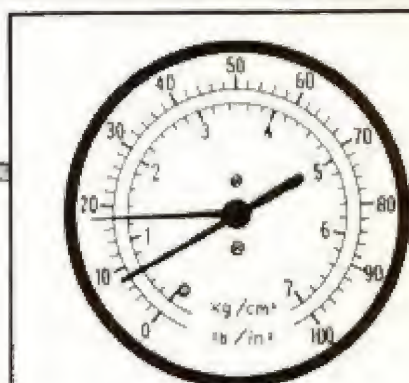
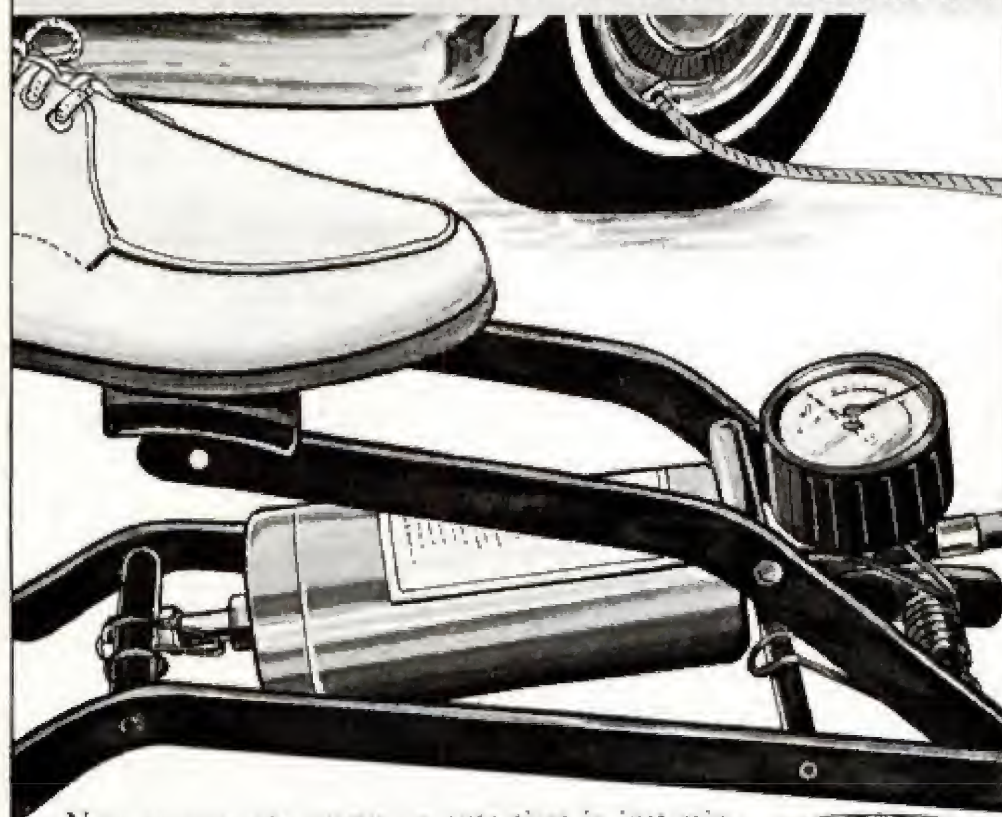
Inverted upper chest (shown) is rabbeted along its bottom edges to receive the plywood bottom piece (M3). For visual clarity, M3 is shown with the rabbet facing inward. When assembled, however, the rabbeted bottom is reversed to fit into the recess in the top of lower chest. (See art.)



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BUILD PM'S TOOL CHEST

(Continued from page 166)

view of handle). Use two 6d finishing nails to hold M1 in the rabbet while glue dries. Turn the lower chest half upright and weigh the handle down so the glue joint at the base is tight with the plywood. Be sure the drawer locking mechanism moves freely. Install compression springs. When dry, invert the section and reinforce the glue joint of the handle base with screws.

Assembling upper chest half

Make a dry assembly of the upper case. Then coat the side and top joints with glue. Assemble the long frontpiece and backpiece to the lid top first, then join the endpieces. Clamp together and check carefully for squareness. When dry, saw the lid free. The saw kerf should split the dovetails in half at each corner. Use a hollow-ground planer blade to make the cut when possible since it will leave a narrow kerf. Install plywood bottom M3 last.

The Soss hinges, retaining chain, chest lock and top handle should be installed next. Also build and install the sawholder. The 1/4-in. stock can be planed down from 1/2-in. stock—or ordered specially from Craftsman Wood Service Co. (See suppliers list.) Glue up the retainer block (B) from smaller stock. Size the slots to suit your saw collection. We made room for everything from a crosscut to a keyhole saw.

The plunger which engages the drawer should be installed next. The plunger can be turned on a lathe from steel or aluminum or it can be made by inserting a 3/8-in. dowel into the center of a 3/4-in. dowel. With the chest halves fastened together, mark the location for the plunger hole and bore it through to the depth of the notch in piece F. Glue the plunger guide (I) to the inside of the front board so that the plunger aligns with the holes.

Finishing touches

Personalize your chest with a decorative medallion or initial inlays. Afterwards, stain as desired. Then rub the entire case inside and out with an oil-type polish such as Watco Natural Finish oil. Felt can be applied to the inside of the drawers. Complete your case by installing an engraved nameplate on the sawholder.

PM

SUPPLIERS

Construction materials: Craftsman Wood Service Co., 2727 South Mary St., Chicago, Ill. 60608. Send 50 cents for catalog which lists prices for cherry stock required to build project.

Nameplate: Creative Awards by Lane, 32 West Randolph St., Chicago, Ill. 60601.

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Front-seat comfort was judged good to excellent by 97.8 percent of our owners, while only 24.9 percent gave the rear seat that rating. Although some owners complained of cramped rear legroom and head space, many weren't bothered by the tight aft compartment. "My dog fits fine in the rear seat," smiles a California computer programmer, "which is one reason I chose the Prelude over the Accord. I never have occasion to carry people passengers back there."

Riding comfort and handling came in for a good measure of praise. "Ride and handling are superb," says a Wisconsin teacher. "I owned an Accord before this, and the Prelude handles and rides even better." "Handles like a dream," echoes an Illinois advertising man. And a Texas mechanical engineer adds, "Great cornering with front-wheel drive. What I lose on the straights I gain in the turns."

Reactions to the Prelude's smoked-glass, electric sun/moonroof ran hot and cold, as did reactions to the optional air conditioner. A woman in Minnesota stated that the sunroof made airconditioning unnecessary. However, several owners in warmer climes said that their cars trapped heat inside.

"When the air conditioner is on," says a

Georgia clerk, "it affects engine rpm. The engine won't idle steadily. It starts to shake." And a Mississippi elementary-school teacher complains, "The air conditioner needs to perform better—it doesn't put out enough cold air."



Front seats recline, but unless they're fully forward, rear legroom is tight.

We asked owners to list their specific praises, and here's a random sampling:

A Michigan respiratory therapy supervisor beams, "Handles wonderfully on the road; really peppy. All my driving is highway, and I've been getting very good mileage. Unique dashboard, with everything in easy reach of the driver."

An Illinois marketing manager: "Road handling is superb. Corners well at all speeds. I always feel in control. Peppy—good passing power even in fifth."

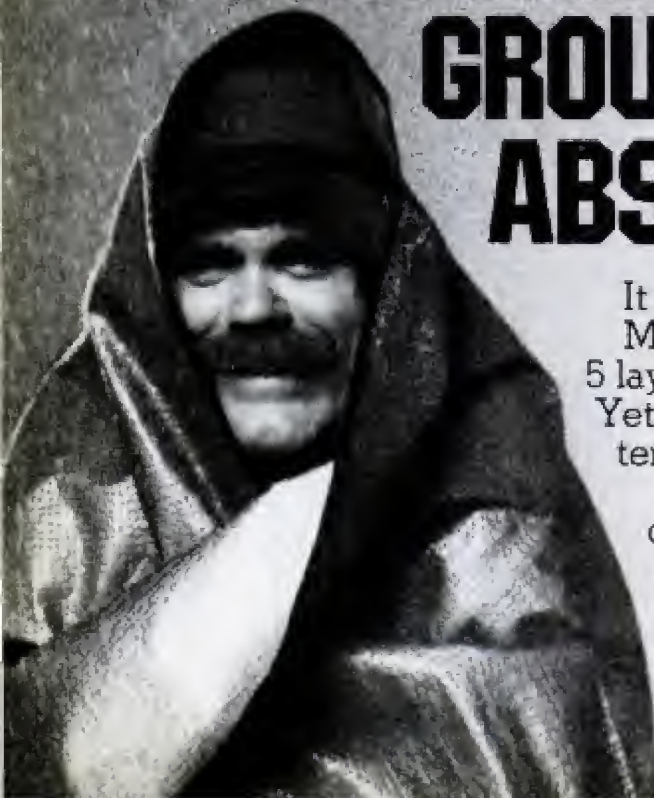
We also asked owners to list specific complaints and suggested changes. Here's a cross section:

A California realty man: "I hate the engine popping on deceleration. One of Honda's main selling points is its ability to burn regular gas. But the only way it'll run right is to change plugs every 4000 to 5000 miles."

A Florida electronics firm president: "Impossible to upgrade the radio or install a tape system because of the weird radio." And a Texas printer's rep adds, "Speakers seem cheap. They sound like they've blown out, although I've never had the volume up loud."

A California writer: "I'd like a wider choice of colors and interiors. Also, the rear seat should fold down and open into

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the trunk, something like the Mazda."

A Florida insurance broker: "I feel that the optional power steering is too sensitive at highway speeds, resulting in a loss of road feel."

But the overall consensus was overwhelmingly in favor of the Prelude. Among owners polled, 81.2 percent said they'd buy a Prelude again next time—a high percentage considering the 2+2 na-

ture of the car and the youthfulness of most owners.

A Florida pharmacist rhapsodized, "Before I bought this Prelude, I owned a 1977 Accord with 60,000 miles on it. No repairs. When I looked at the Prelude, I was willing to buy nearly any car Honda made. I haven't been disappointed. I'd strongly recommend the Prelude to anyone looking for a good, dependable, eco-

nomical, fun automobile. I only hope that American automakers learn from Honda that it's possible to build a good car for under \$10,000—one that gets good gas mileage, has quality workmanship, low pollution, and runs on leaded gas."

And finally, a California data processing manager limns, "I love it! It's the best car I've ever owned. At \$7000, it's a steal!" **FM**

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Total miles driven 1,424,508	Sunroof 17.4	Fair 1.8	Good 39.1
Average miles per gallon	Specific dislikes:	Poor 0.3	Average 17.6
With five-speed manual	No complaints 18.9%	Comfort opinion (rear seats):	Fair 5.7
In town 27.1	Legroom, especially rear 14.2	Excellent 3.2%	Poor 8.4
Long trips 33.3	Poor radio controls 9.0	Very good 5.4	
With automatic transmission	Uncaring dealer service 8.7	Good 16.3	Number of vehicles owned:
In town 24.0	Seat shape and height 7.7	Fair 27.9	Prelude only 39.3%
Long trips 28.5		Poor 47.1	Two cars 40.5%
			Three cars 11.4
Transmission choices:	What changes would you like?	Had any mechanical troubles?	Four or more cars 10.7
Five-speed manual 86.4%	More rear legroom 19.7%	No 69.9%	
Automatic 13.6	No changes 12.2	Yes 30.1	Makes of other cars owned:
	Seat shape/style 9.4		Chevrolet 18.7%
Why did you choose the Prelude?	Greater color choice 9.4	What type of trouble?	Honda 16.3
Styling 67.0%	Better radio-control location 9.4	Carburetor 18.6%	Ford 15.3
Economy 50.2		Sparkplugs 14.4	Cadillac 11.8
Uses regular gasoline 15.9	Workmanship opinion:	Transmission 9.3	Pontiac 9.9
Honda's reputation 11.1	Excellent 64.9%	Rough airconditioning compressor 8.2	
Handling 9.6	Good 31.2	Engine hesitation 7.2	Age distribution of owners:
Owned Hondas before 9.6	Average 3.0		Under 20-29 years 49.7%
	Fair 0.9	Dealer repairs satisfactory?	30-49 years 42.1
	Poor 0.0	Yes 58.2%	50-plus 8.1
		No 41.8	Would you buy another Prelude?
Specific likes:	Comfort opinion (front seats):	Dealer-service opinion:	Yes 81.2%
Economy 60.4%	Excellent 61.4%	Excellent 28.2%	No 18.8
Styling 56.5	Very good 29.2		
Handling 48.9	Good 7.2		
Comfort 23.1			

*Percentages might not equal 100% due to rounding or insufficient data.

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Cockpit model

The VDO **OUTSIDE TEMPERATURE GAUGE** warns you of icy roads ahead by blinking an "icy roads" alert when the temperature drops to 37°F.

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VOLTMETER
TopCockpit model

(Cockpit model also available)



VACUUM GAUGE
Cockpit model



VDO
AUTOMOTIVE
INSTRUMENTS

Winchester, VA 22601



VDO AUTOMOTIVE INSTRUMENTS
VDO-ARGO Instruments Inc., 980 Brooke Rd.
Winchester, VA 22601

RT-11

- ☐ Send 1980 catalog showing VDO instruments and how to use them
☐ I'm a biker. Send me your 1980 motorcycle instrument catalog

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ADDRESS _____
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IT'S NEW NOW

Plug in your recipes

The Sunbeam Model 39-10 microwave oven "reads" recipes from magnetic Menu-Matic cards. It comes with 20 prerecorded recipes; other recipes can be recorded on 10 reusable blank cards. A card is inserted and a code punched out to record cooking instructions. About \$650. Sunbeam Microwave Co., 2001 South York Rd., Oak Brook, Ill. 60521.



Rechargeable flashlight

The halogen lamp in Streamlight SL-15 is claimed to throw five times the light of a standard unit. Batteries recharge up to 1000 times, the maker says. About \$80 with recharger. Streamlight Inc., 1030 West Germantown Pike, Norristown, Pa. 19401.



Here's a desirable meltdown

The 20 temperature-indicating crayons in the Temprobe kit are each designed to melt at a specific temperature between 125° and 800° F. Simply mark a surface with a crayon; when the mark melts, the rated temperature for that crayon has been reached. Accuracy is guaranteed to ± 1 percent. A special metal holder for the crayons is included. The kit is \$10 from Tempil, Hamilton Blvd., South Plainfield, N.J. 07080.



Experimenting with fiber optics

The Optimate Fiber-Optic Experimental Kit has all the semiconductor devices, printed-circuit boards, optical connectors and cables needed to build six prototype fiber-optic transmission systems. The maker claims the kit, along with capacitors, resistors and hand tools, is all that is required to learn about fiber-optic system design. About \$350. AMP Inc., Harrisburg, Pa. 17105.



Walk the plank

The Sternmore mooring system swings out of the way when not in use. It can also serve as a boarding ramp. For floating or stationary docks, it is suitable for boats 12 to 24 feet. The 32- and 48-inch sizes are about \$165 and \$175, respectively. Frog Hooks Inc., Box 150, South Salem, N.Y. 10590.



Picks up where a car leaves off.

GMC



Trucks are what we're all about.

washer-dryer combo, routine. And when, may we ask, was the last time the old 4-door sedan, or even a station wagon, conveniently handled that?

Select from a range of timely engines: the standard in-line 6, or an available gas or diesel V-8. (These GMC's are equipped with GM-built engines produced by various divisions. See your dealer for details.) Transmissions? Depending on the model, you can pick from the standard 3-speed manual, an available automatic or 4-speed manual.

To help keep your pickup looking good, some steel parts have been specially precoated and treated with rust-fighting compounds. And you can make your pickup cab quite comfortable indeed, with available power assists, air conditioning, and more.

If all this sounds very appealing to you, we have a suggestion. First chance you get, stop by your GMC dealer, drop off your car, and pick up a new GMC.

Do you occasionally wish your present car could travel the kinds of roads, carry the types of loads, that might make life a trifle easier and more interesting? It's time then to dismiss sigh-filled fantasies and consider instead our realistic solution: a GMC pickup. It can go places and do things that give most cars problems.

There's independent front suspension on 2-wheel-drive models. The double-steel-constructed Wideside pickup box sides and tailgate help make hauling canoes, camper tops, or even the

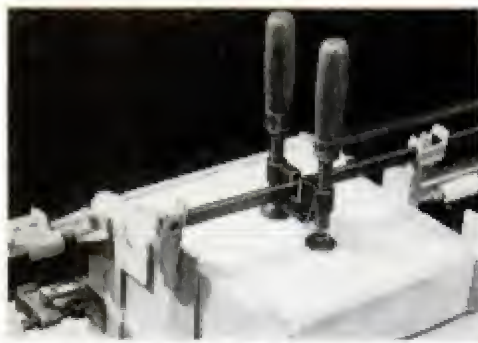
1980 GMC Pickup	EPA Est. MPG	Est. Driving Range With Optional Auxiliary Fuel Tank 720 miles
	18	

Remember: Compare the estimated MPG to the "estimated MPG" of other vehicles. Your mileage and range will depend on your speed, weather and trip length. The range estimate is obtained by multiplying the EPA estimate by the 40-gallon fuel tank capacity. This includes the standard 20-gallon fuel tank plus the optional 20-gallon auxiliary fuel tank for a total of 40-gallons. Estimates lower in California.



GMC is a division of General Motors

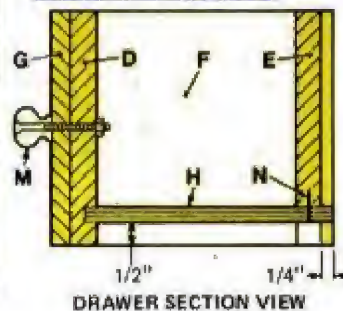




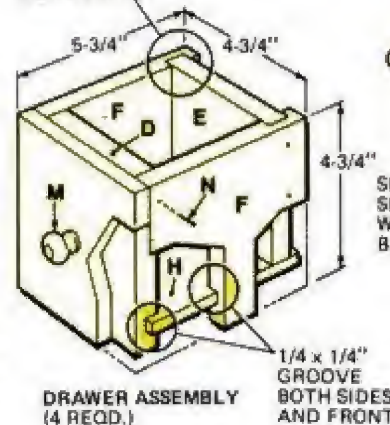
Apply glue sparingly to joints, keep clamps on overnight. Screws go in next day.

CHRISTMAS GIFTS

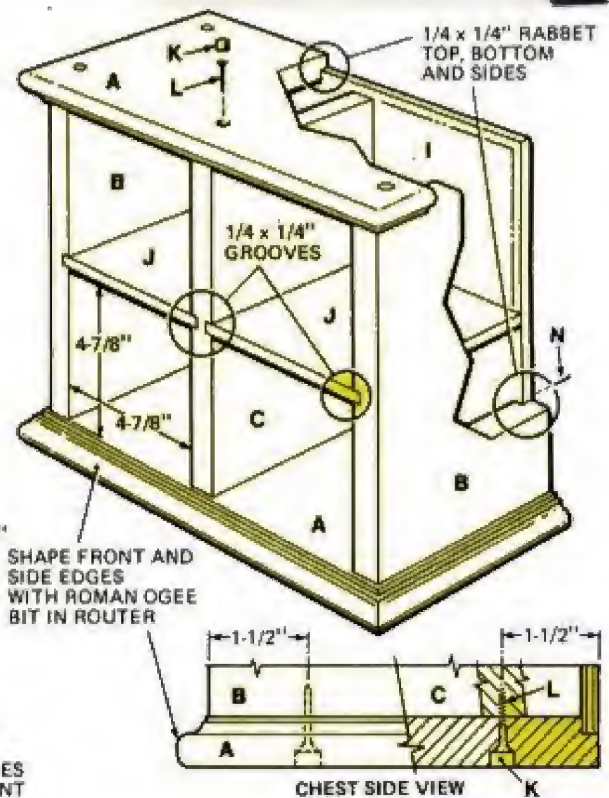
(Continued from page 128)



1/4 x 1/2" DADO (BOTH SIDES)



DRAWER ASSEMBLY (4 REQ'D.)



CHEST SIDE VIEW

off all the parts with a tack cloth.

7. The unit shown was finished as follows: a) all wooden parts were sealed with a coat of shellac thinned 50 percent with denatured alcohol; b) dry shellac was sanded lightly, using 180-grit paper, dusted and tacked off; c) a coat of Pratt and Lambert satin-finish varnish was applied, as it came from the can, and allowed to dry for 24 hours; d) a light sanding with 220-grit paper followed; e) after dusting and tacking, a second coat of the varnish was applied, as it came from the can.

Allow the box to dry for at least 48 hours before putting it into service.

Note: The finish has the look of handrubbed wax, but if you're a purist who insists upon waxing his Colonial reproductions, it's a good idea to wait at least three weeks before waxing.

MATERIALS LIST—COLONIAL SPICE BOX

Key	No.	Size and description (use)	H	4	1/4 x 4 1/4 x 5 1/4" (drawer bottom)
A	2	1/4 x 6 1/2 x 13" (top, bottom)	I	1	1/4 x 10 1/4 x 11" (cabinet back)
B	2	1/4 x 6 x 10" (side)	J	2	1/4 x 5 1/4 x 5 1/4" (horizontal divider)
C	1	1/4 x 5 1/4 x 10" (vertical divider)	K	12	3/8"-dia. dowel plug
D	4	1/2 x 3 1/4 x 4 1/4" (drawer front)	L	12	1" No. 8 th screw
E	4	1/2 x 4 x 4 1/4" (drawer back)	M	4	3/8"-dia. ceramic knob, Amerock T705
F	8	1/2 x 4 1/4 x 5 1/4" (drawer side)	N		1/4" brads (as required)
G	4	1/4 x 4 1/4 x 4 1/4" (drawer face)			

10 Cutting board

For practical reasons, use a close-grained hardboard, such as maple or cherry, for the cutting board. Start by buying the bowl that the cutting board will be made for. If necessary, alter the half-moon cutout to suit bowl diameter. Also, make certain that the legs are spaced so that the bowl can be stored between them.

1. Lay out and cut parts for the legs and top, using the drawing as a guide.

2. Plow the dadoes in the top's underside, using the dado head mounted on the bench saw. To prevent excessive splintering on the edge (where the cutters leave the board), butt a second board tightly against the board being cut.

3. Sand all parts smooth. Start with 100-grit paper; increase fineness to 120 then 180. Dust off. Tack.

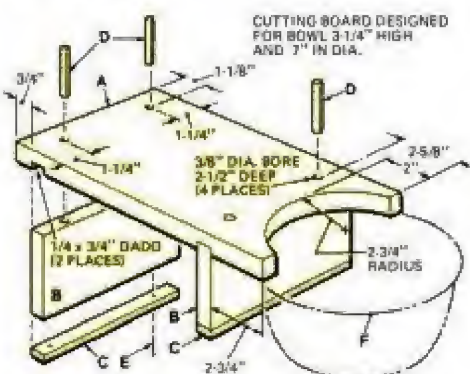
4. Using white glue and 1-in. brads, attach the cleats to the bottoms of the two legs. Then attach legs to the top, using glue and clamp overnight.

5. Next day, remove clamps and bore holes for counterboard screws and dowel plugs (or use dowels alone to secure top to legs).

6. Since foodstuffs will be in contact with the cutting board, do not use a toxic material such as varnish to finish the piece. Instead, rub the wood with mineral oil. You should wash the board after each use with soap and water, then periodically re-oil it with mineral oil.

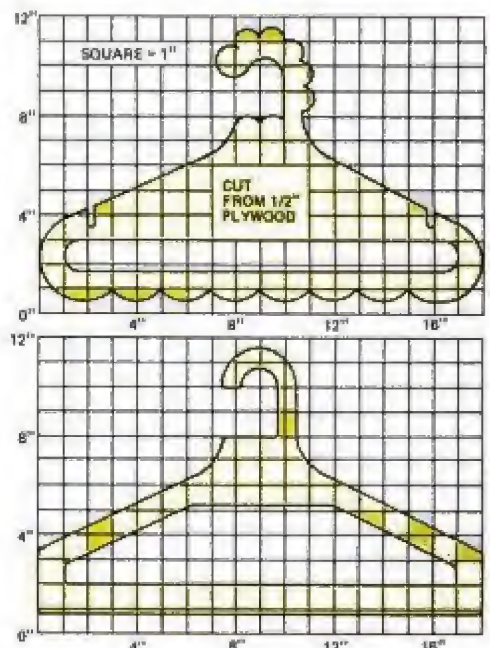
MATERIALS LIST—CUTTING BOARD

Key	No.	Size and description
A	1	1/4 x 6 1/2 x 12 1/2" maple
B	2	1/4 x 3 1/4 x 6 1/4" maple
C	2	1/4 x 1/4 x 6 1/4" maple
D	4	3/8"-dia. x 2" maple panels
E	4	1/4" brad
F	1	S/S bowl 7"-dia. x 3 1/4" high



11 Hangers

Our hangers are made of 1/2 in. A-C plywood, but you could laminate 1/4-in. hardboard back to back if you want both surfaces smooth. Lay out the hangers using the grids above, and make the cutouts with either scroll or sabre saw. Sand all edges smooth (and fill voids in plywood edges with plastic wood filler).



Prime paint with a pigmented shellac, allow to dry and lightly sand-dust and tack off. For a high gloss, we sprayed the hangers shown with LeSpray paints.

To make one hanger, you need one piece of 1/2-in. plywood, 12x18 in. Miscellaneous materials are wood filler, sandpaper, pigmented shellac and glossy paint.

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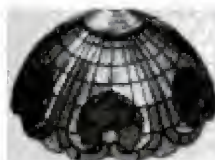
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TODAY'S GREAT CAR SPEAKERS

(Continued from page 89)

simple item, it has now taken several interesting engineering turns.

Manufacturers discovered that while a car provided some distinct acoustic advantages over a living room, it provided some pitfalls, as well. The good points include a relatively sealed cavity, or enclosure, and reflective surfaces. However, a car speaker has to contend with both high noise levels and a remarkably uneven acoustic area.

Recently, several companies have addressed themselves to this area and have designed speakers specifically to compensate for the car's deficiencies. These, therefore, are speakers you would *never* want to use in the home.

Advent's car speaker looks like a conventional 6x9-inch, but it isn't. It carries its own power with it and both components, speaker and amplifier, are complementary and designed to mate with the car's acoustic characteristics to yield the proper tonal balance. Again, design technology is expensive. Advent says that a great deal of time was spent in trial-and-error designing.

Like Advent, EPI is another well known home-speaker manufacturer. This company has packaged its well regarded EPI 70 speaker system in a 6x9-inch car format. The LS 70 is a two-way system, with a 6-inch-long woofer and 1-inch air-spring tweeter. The woofer is round in shape, rather than the more familiar car-stereo oval. The LS 70 sounds rich, full and tight. It sells for \$150 per pair.

Jensen and AFS Kriket have also done a lot of research on improving car speaker acoustics. Kriket's Model 8974 Domaxial 6x9-inch utilizes a 20-ounce magnet and coaxial speaker design, with a standard woofer and 1-inch dome tweeter. It's a smooth system, putting out more bass response than most surface-mount speakers. Kriket makes its flush-mount Domaxials in a variety of configurations for mounting in doors, kick panels and dash. The 6x9-inch sells for \$110 per pair.

In designing its new Series II line, Jensen virtually went into the auto coach business. They built themselves a model car and designed and tested speakers in it. The Triax II is the second generation of Jensen's 6x9-inch Triaxial speakers. They don't replace the original Triax, but add a dimension to it. The patented Triax approach is to put three drivers on one basket, yielding a three-way speaker system. It uses a 20-ounce magnet. The Triax II's sug-

gested list price is \$140 per pair.

Clarion's SK-103 speakers were the first to use a full 6x9-inch woofer, along with an independently mounted dome midrange and dome tweeters. The domes help with the dispersion of sound and don't block the lows coming from the woofer. The speakers, utilizing 20-ounce magnets on the woofers, go for about \$175 a pair. Clarion was the first to conceptualize and market speakers designed in this manner.

Speaker variations

While the most popular speakers are the rear-deck variety we've examined, there are other types and other placements. As we indicated, you might want to use one of the slim-line door or kick-panel speakers if your rear panel is a problem, but also there's a move to multiple speaker installations for sound enhancement.

To start with, Craig has standard 5-inch round speakers, suitable for placement in either door or kick panel. That, in itself, is not unusual. Most all flush-mount speaker lines have such a speaker. What makes Craig's unusual is that it is the central component in its 6x9-inch vented rear-panel speaker. The 6x9-inch or 5-inch versions sell for \$100 per pair.

EPI's LS35 is an auxiliary flush-mount speaker designed for front-compartment installation, while the main speakers are in the rear deck. A pair of 35s comes with an LCS Level Control System front/back equalizer and sells for \$75. The Level Control System is sold separately for \$40.

Jensen, too, has an auxiliary system—the Series II tweeter/midrange and crossover/control unit. The crossover/control unit mounts under the dash, has left and right continuously-variable controls. The price is \$700.

AFS Kriket has developed a whole line they call "audio separates." The line includes their 6x9-inch domaxial bi-amplifier compatible speaker, 6x9-inch sub woofer, 5-inch mid-woofer, dome tweeter, and an environmental equalizer to properly balance the components. The full system is intended for RVs, trucks and large cars and has an appropriately high price tag. However, you can select the multiple components which suit your needs and install just those.

We've come a long way from the days of easy choices. Cars and their accessories are more expensive. So if you must wait on a gas line, at least you can listen to music that sounds second to none.

PM

Henry Morgan says: "Good appliance repairmen are scarcer than doctors who make house calls."



Did you know that there are over a billion appliances in use in the United States today? And three repairmen. At least that's the way it seems when one of mine goes on the blink. With more than two dozen electrical gadgets in my house going snap, crackle and pop, I finally got tired of trying to locate a guy with enough ambition to take my money and I decided to learn how to make the repairs myself.

When a well-aged comic like me decides to go back to school, you can bet the family jewels it won't be back at P.S. 93. I'm going to learn at home, or not at all. So I sent away for NRI's home study course in Appliance Servicing...and I took the course.

With a mechanical aptitude slightly below that of King Kong, I needed a course that started at the beginning and didn't move ahead too fast. Well, NRI did just that. They started with electricity—what it is and what it does—and went from there. You proceed at your own rate of speed. Whip through it if you want to, or take your time. What counts is the fact that you learn, in a way that it sticks with you.

You learn two things: how to repair appliances—from food processors and microwave ovens to refrigeration and air conditioning equipment—and how to get started in your own appliance business. That can mean money for you either way. If NRI can turn old ten thumbs Morgan into a reasonable facsimile of a repairman, think what they could do for you!

NRI's no fly-by-night outfit. They've been training people for more than sixty-five years...and they've had over a million students. It's the oldest and largest home study school in the field of electronics and electricity, so they know it better than anyone else around.

The NRI course is really easy to understand...with lots of pictures to show you what they're talking about. They even send you the tools you need at no extra cost. Depending on which level of training you select, you'll get professional hand tools, test meters, and demonstration equipment that lets you see the circuits you've been reading about.

In just a few months, you'll be fixing your own appliances like I do. Then, you can start earning spare-time money fixing them for your friends and neighbors. Before you know it, you can have your own full-time business and be independent.

Take my advice and mail the postage-paid card for a free catalog describing the courses, tools, and lessons in detail. Even if you don't know which end of a screwdriver is the handle, they can give you real professional training that'll help you break into the appliance repair field. It's one of the few things I've ever sent for that was even better than they said it would be. The NRI catalog is free and there's no obligation. No one will knock at your door or bug you at home. NRI doesn't use salesmen. They don't need them.

Take it from Henry Morgan, the appliance repair field could sure use some good men. Now. If somebody else beat you to the postcard, write to NRI at the address below.

Henry Morgan



Or look into these other growth fields

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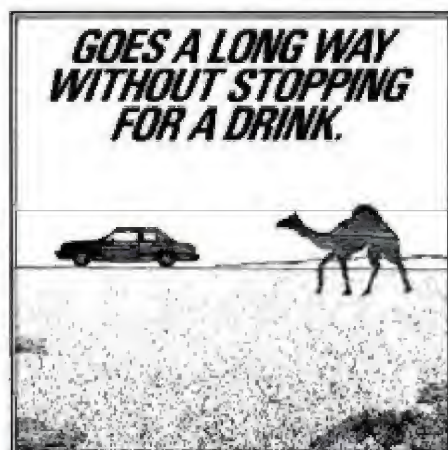
With its 22 EPA estimated mpg and 22-gallon gas tank, Concord

covers a lot of territory without getting thirsty.** Something to think about this weekend.

And Concord DL gives you standard comforts and conveniences that competitive cars charge more for. Individual reclining seats, quartz digital clock, full vinyl roof and much more, at no extra cost. It is truly "the more luxurious, more affordable compact."

All of this adds up to a luxury compact that's truly built to last. So you can expect lasting value in the years to come.

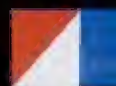
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PM LOOKS AT BIRD'S VINYL GUTTERS AND LEADERS



Final touch: Gutter hanger is snapped into gutter lip to complete installation.

Drop outlet goes up first, then gutter brackets are installed along chalkline.



Gutter connector requires some notching for a slide fit into abutting gutters.



After applying PVC cement, connector is slipped onto the first gutter section.



Cold rivets are used to secure joint. Then second gutter section is added.

As an ex-contractor, I have installed my share of gutters and downspouts. Although installing them is not my favorite pastime, a number of recent queries from readers about vinyl gutters prompted me to install some. Surprisingly, a clerk at the local roofer's supply house said "I don't think they're making vinyl gutters anymore." He's wrong. Several major firms do produce them. I ordered mine from Bird & Son.

The manufacturer's booklet of installation instructions is excellent. My 17-year-old son and I reguttered my 26-ft.-long workshop in a single morning. The vinyl cuts with ordinary saws, and is secured with PVC cement and cold rivets. To obtain additional information, write to Len Niese, Bird & Son Inc., Washington St., East Walpole, Mass. 02032—Harry Wicks, *Home and Shop Editor*



Downspouts are conventionally installed with galvanized nails securing straps.



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HINTS FROM READERS

Gluing and soldering clamp



Here's an easy way to gain a bench-top "third hand" that holds pieces secure for gluing, soldering and the like. Simply attach the parts of a photo-lamp clamp to the base of an old electric iron as shown.

—Ken Patterson

Magnet aids cleanup



A strong magnet picks up steel-wool particles that fall on a workpiece while it's being rubbed smooth. Cover magnet with plastic wrap held by rubber band for easy cleaning.—Walter E. Burton

Foil protects pipe



Cover the openings of pipes and fittings with aluminum foil when storing to keep dirt from depositing. To secure foil, press it into the threads.—I. M. Raymond

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PM LOOKS AT TORO'S ELECTRIC CHAIN SAW

Toro's new, lightweight electric chain saw makes short work of most yard cutting chores. It's also the ideal tool for cutting firewood.

Although the power-supply cord is a limitation in some cutting situations, electric power makes up for it. You never have to mix fuel or re-fuel while on the job. Best of all (for our money) is a lack of starting problems. A handy chain-oiling button and special, nonsymmetrical guide bar, designed to reduce chance of kick-back, are also noteworthy.

Tip: When using a 50-ft. extension cord with this saw, be sure the wire size is at least No. 16. At 50 to 100 ft. it should be No. 14; at 100 to 150 ft., No. 12.—H.W. and J.P.

SPECIFICATIONS—ELECTRIC CHAIN SAW

Power rating: 1 hp; current draw 9 amps.; UL listed
Price: \$70 (complete); saw chain replacement, \$14; guide-bar replacement, \$16.
Maker's address: The Toro Co., One Appletree Square, 80009 34th Ave. S., Minneapolis, Minn. 55420.



Electric chain saw has sleek looks, power.



To assemble, remove guide-bar hex nut, washer and sprocket cover; loop chain over sprocket. Position slot in bar over guide-bar bolt and secure with hex nut.



Saw is shown as it comes from maker.



To increase saw chain tension, loosen hex nut, turn tension screw clockwise.

OH
WHAT
A
FEELING



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ning ground clearance of any small 4WD, to help save you from getting hung up on the hard stuff.

The Toyota's high-riding good looks and fancy interior haven't hurt its popularity any, either. The Sport Truck model has locking front hubs, full carpeting, AM/FM Multiplex stereo radio and full instrumentation —standard. Tilt steering wheel and

power steering are available options.

Surprised that a new design could be so good so soon? Don't be. The Toyota 4-Wheel Drive Truck is the "Son of a Land Cruiser." We put our 30 years of experience building one of the world's toughest 4-wheel drive vehicles into it.

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How to make your own paint remover



The supplies you need to make paint remover inexpensively are readily available. They include: lye or TSP as a stripping agent, laundry starch for thickening the solution, paint scraper, laundry bleach for restoring natural color to wood, and a metal bucket so you can mix your solutions. You must use a scrub brush with natural fiber bristles or a cotton mop to apply the paint remover to a surface. Alkali will attack many other materials. Author made a good disposable mop by wiring strands cut from a cotton floor mop to a broom handle. You can also attach cotton rags to a stick.

Paint dealers don't tell you these secrets, which cut the cost of removal materials so low there's no profit in selling them.

by Charles Rhine

No matter how you look at it, stripping off old paint to get the wood ready for a new paint coat is a messy job. But it's getting to be expensive, as well. Chemical-solvent paint removers are priced in the \$7- to \$17-a-gallon range and they're still rising. The better paint removers make the job a bit easier, but they also cost the most.

Many homeowners are discovering what professional painters and furniture refinishers have known all along: One of the best and least expensive ways to strip a large surface of old, hard paint or varnish is with a strong solution of household lye in water. You can buy lye at the supermarket or hardware store for about 59 cents a can.

Lye can be handled safely

If mention of the word lye (sometimes called caustic soda or sodium hydroxide) brings to mind some great danger, it shouldn't. Anyone who is used to handling the common

brands of drain and oven cleaners won't have any trouble. Most of these items are lye. It's the same lye that grandma used to make soap.

Oven and drain cleaners will remove paint, as any housekeeper who has accidentally spilled some on woodwork will testify. But that's an expensive way to get the job done.

The cheapest way to remove paint is to get bulk quantities of the cleansers from a chemical supply house, or buy smaller containers of plain lye at your local grocery or hardware store. You'll usually find

lye on the shelf with the oven and drain cleaners. Red Devil markets household lye nationwide in 13-oz. plastic containers.

Even the more expensive chemical-solvent type paint removers are not entirely safe. Most of them contain methylene chloride and other solvents that force the manufacturer to put them in containers aglow with warning notices.

Lye has no toxic fumes. It's non-flammable, so it won't explode in your face if you get near a flame. Do be careful not to splash it on your skin, though. It can give a nasty burn. But it may do little or no damage if it's flooded with water immediately.

For insurance, do wear rubber gloves, long sleeves and eye protection; keep a garden hose or several buckets of clean water handy and work carefully. Also be sure you don't breathe any of the dust when

(Please turn to page 188)



Always pour the lye into the water. Don't pour water into lye; reaction is violent.



Stir as you add lye; then get it piping hot. 'Remover' won't work below 65° F.



When working outdoors, a portable gas heater keeps the solution hot. Use cornstarch to thicken the mixture.

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David Graham, Texas

Graham worked at a chemical company for 13 years, day in and day out. But the only thing he'd acquired was tenure. "I was tired of worrying about the bills and looking at price tags," Graham says. "And I had an old car that wouldn't shine no matter how hard I waxed it."

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MAKE YOUR OWN PAINT REMOVER

(Continued from page 187)

you're pouring lye out of the can.

Another inexpensive paint remover is trisodium phosphate or TSP. It is sold by paint and hardware stores with the recommendation that it be used for heavy-duty cleaning.

Make a stronger mixture of TSP



Layers of tough, hard paint seem to melt under the action of a hot lye solution.



Brush on full-strength laundry bleach to restore the wood to its natural color.

for removing paint than you would for cleaning. Heat it to near boiling and presto, you have the poor man's answer to the rising cost of paint removers. The Savogran Co. markets TSP in 1-lb. boxes, but you can get it in larger quantities for less money at a chemical supplier. Check your local directories to locate one of these.

TSP is not as caustic as lye and it takes a little longer to do the job. However, you handle it with the same precautions as you take with lye.

These alkaline solutions are fine for stripping paint from metal, as well as wood. Just don't use them on aluminum. They're also among the few things that will remove old milk paint or casein-type finishes. However, the solutions have no effect on some of the modern finishes based on urethane, alkyd or epoxy resins.

Water-solution disadvantages

The biggest problem using a water solution to remove paint occurs when you try to strip furniture or veneer put together with glue that isn't waterproof. You could wind up with a pile of furniture parts. This is okay if the piece needs re-gluing anyway. Replacing buckled veneer,

(Please turn to page 190)



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literally fuses itself to the finish of your car by "molecular bonding". And it contains a formulation similar to that used to make those "non-stick" frying pans, so it's so glossy smooth that practically nothing will stick to it! Even bird droppings and crushed insects simply slide off with the touch of a damp cloth.

**It takes less than 60 minutes
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Now you can get the identical protection for your car with Glasscote, and **all you need do is all the dealer does** — wipe it on, let it dry, and wipe it off! So why pay somebody \$85-\$200 an hour to do it for you? Why not buy Glasscote direct-by-mail for only \$5.98 — enough for three years treatment for a small car — more than enough to Glasscote even the biggest Mercedes, Rolls, or Cadillac for 12 full months! Simply wipe it on once a year and **forget about all that waxing, polishing, and buffing forever!** A simple soap and water washing or a wipe with a damp cloth restores the gloss!

Even if your used car is already dingy looking from oxidation, Glasscote helps remove it and restore a brighter color and more glossy shine.

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MAKE YOUR OWN PAINT REMOVER

(Continued from page 188)

however, is a rather difficult task.

If the joints are sound but the glue is water-based, strip a small area at a time and wipe each section dry as you finish it.

Alkaline solutions will darken the color of the wood. This is easily corrected, as explained later. They also raise the grain of the wood, so you'll have to go over the entire piece with fine sandpaper. Lye will eat up wood if left on the surface long enough, but this is no problem in the short time it takes to remove paint.

Finally, because the water soaks into the wood and joints, it takes several days to dry. Wait until then to refinish the piece.

How to mix paint removers

These strong alkali strippers must be mixed in a steel or iron pail. *Never use an aluminum one* because it will deteriorate. The heat produced by the reaction of lye and water can also shatter glass, stoneware or ceramic containers. Plastic won't do because it will melt with the heat.

An enamel-coated garbage pail works just fine. A galvanized bucket will do, but in time the solution will dissolve the zinc coating.

Don't fill the bucket more than about half way, so the solution doesn't boil over the edges. It is also less likely to slop out when you're working with a smaller amount.

Most important: Always pour the

powdered alkali into the water, not the other way around. This is particularly true for lye, which may otherwise spatter. Use a wood stick to stir the solution as you pour.

To thicken the solution so it won't run off the surface, add regular household laundry starch. The gel-like paste that's produced will even cling to vertical surfaces.

When mixing lye, start with lukewarm water. Lye dissolves too slowly in cold water, but reacts violently in hot water. Mix TSP, on the other hand, with hot water.

I use one 13-oz. container of lye to 3 qts. of water. Some experts recommend a stronger solution.

Start by mixing the lye in a quart of lukewarm water. In another container put 2 qts. of cool water and stir in four heaping tablespoons of laundry starch. Then pour the lye solution into the starch solution while you stir.

Use about a pound of TSP to a gallon of hot water. Then stir in about a cup of starch to thicken it.

Keep the solutions hot

Both lye and TSP work best when the solutions are applied piping hot. Don't even try to do the job if the temperature of the solution is below 65° F. For ideal results, heat the mixture on a stove but do not bring it to a boil. Work in the sun. If the solution cools, reheat it.

To apply the solution to the surface, use a scrub brush with natural

(Please turn to page 192)

THREE EASY STEPS TO FURNITURE STRIPPING



First mop on a hot lye solution (above, left). The sun helps the lye work; plastic protects grass. After varnish softens to the wood, it washes off easily with a garden hose (top, right). Laundry bleach restores wood color (bottom, right). Flush with water.



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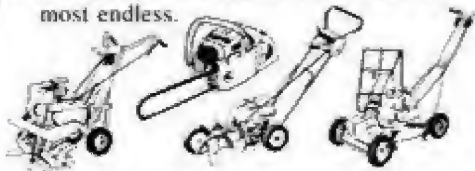
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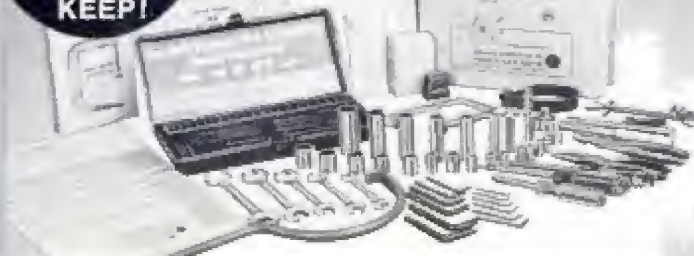
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Before repainting a house, use a long-handled brush and hot lye to strip old paint.



Softened paint hoses right off to expose wood. Scrub with weak acid to neutralize.



A lye-dipping tank makes easy work of stripping used lumber and furniture.

MAKE YOUR OWN PAINT REMOVER

(Continued from page 190)

fiber bristles or a cotton mop. The alkali will attack many other materials. You can make a good disposable mop by attaching some cotton rags to the end of a stick and wrapping the ends with steel wire.

Don't be stingy when you apply the solution; it's not expensive. Don't let the paste solution dry.

How fast the solution works depends not only on the temperature but also on how hard the old paint is and how many layers there are. Most often the remover will take off two or three thick coats of paint in five or 10 minutes. Every few minutes check the action with a scraper to see if the paint has softened down to the wood. Don't leave the paste on the wood longer than is necessary. If the job is a big one, do it by stripping and rinsing a small area at a time.

For final cleanup, simply hose down the wood thoroughly with water. You can also use buckets of water and a scrub brush to do the job. Any spots of paint that don't wash off can be scrubbed off with steel wool.

Never do your paint-removing work on the lawn if you want grass to grow there. A concrete driveway or basement floor is a good place to work if you have a drain handy where you can hose the mess.

Best yet, work outdoors on a sheet of heavy polyethylene film. Excess water and lye can be diverted into a

drain and the sludge can be rolled up with the film and then tossed in the garbage.

Surface neutralizing

When you use strong lye on wood you must neutralize the surface with a weak acid solution before you paint. For example, scrub the piece down with plain vinegar. Brush it into cracks and wood pores and rinse off the water. It's not necessary to neutralize TSP solutions.

Most woods, particularly oak, cherry and mahogany, are darkened by the alkali solutions. However, alkali on some woods, such as pine, maple or birch, produces an antique patina that you may want to keep.

If you refinish the wood with an opaque, colored paint, this discoloration will not bother you one bit. If you want to return the wood to its natural color, however, just brush it down with full-strength Clorox or other liquid laundry bleach. When the wood is lightened to its original color, wash it down again with water. The bleach will work quite fast, so work on a small area at a time so you can control the action.

You don't have to neutralize the wood with vinegar if you are going to bleach it. The bleach will do the job.

Those big jobs

The low cost of using strong alkali to strip paint makes it practical to use on rather large jobs where you wouldn't dream of using expensive paint remover. You can strip the

outside of a house that has had many coats of paint. These layers yield to lye with a lot less work than burning and scraping—and there's no fire hazard. Just get a long-handled scrub brush to apply it. When the solution has done its work, you can wash the whole mess off with the garden hose.

Build your own dipping tank

You might take a hint from industrial and commercial refinishers and build your own dipping tank. With it you can strip an entire piece of furniture at one time.

I built mine using a 55-gallon steel drum. The dipping basket is made of half-inch mesh hardware cloth. I raise and lower the basket in the drum by a rope that runs through a pulley. The pulley is attached to an overhead tree limb.

Besides stripping furniture, I have used the rig to strip the varnish from a quantity of used flooring I picked up at a wrecking job. Bricks in the bottom of the basket help sink it in the solution and a wire cloth lid prevents the object from floating to the top. A portable gas heater positioned under the barrel keeps the solution hot.

Knowing how to remove paint and varnish from furniture and other surfaces to be refinished can open up a whole new do-it-yourself area for you. Making your own paint-remover solutions for the job is one inexpensive way to keep your home and its furnishings looking their best.

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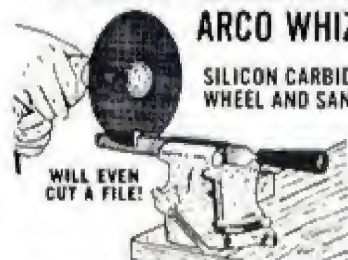
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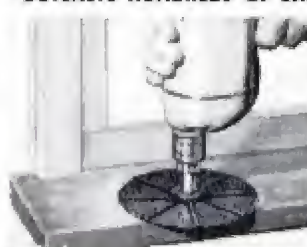
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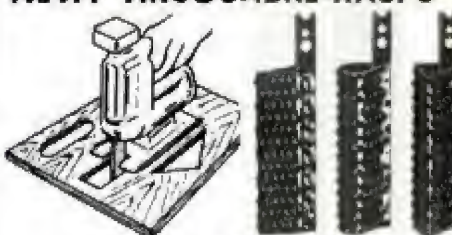
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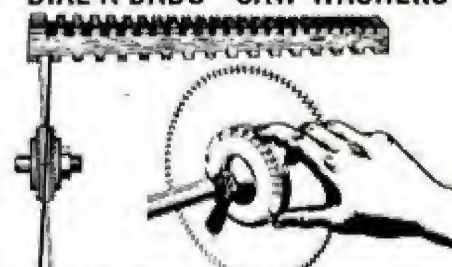


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HOW TO GET DOLLARS TO GO SOLAR *(Continued from page 90)*

tain up-to-date computer files on subjects like solar legislation, solar grants and loans, solar educational opportunities, and information on climate suitability for solar heating. Lists of solar professionals, and of installations open for public view-

ing, along with lists of solar-product manufacturers and descriptions of the items that they make are also available.

The Center's toll-free "sunline" is 800-523-2929 in the continental United States, except in Pennsylva-

nia where it is 800-462-4983. In Alaska and Hawaii it's 800-523-4700. The mailing address is: National Solar Information Center, Dept. PM, Box 1607, Rockville, Md. 20850.—*Joseph R. Provey, Assistant Home and Shop Editor*

STATES WHERE SOLAR DOLLARS ARE AVAILABLE *continued*

State	Property Tax Exemption	Income Tax Credit	Sales Tax Exemption	Grant Program	Loan Program
New Mexico	No	Up to \$1000	No	None	None
New York	Yes	None	No	HUD	None
North Carolina	Yes	Up to \$1000	No	None	None
North Dakota	Yes	5% for 2 years	No	None	None
Ohio	Yes	10% up to \$1000	Yes	None	None
Oklahoma	No	Up to \$2000	No	None	None
Oregon	Yes	Up to \$1000	No	None	For consumers and veterans
Pennsylvania	No	None	No	HUD	None
Rhode Island	Yes	None	No	HUD	None
South Carolina	No	None	No	None	None
South Dakota	Yes	None	No	None	None
Tennessee	Yes	None	No	None	For low- and moderate- income persons.
Texas	Yes	None	Yes	None	None
Utah	No	None	No	None	None
Vermont	Local option	Up to \$1000	No	HUD	None
Virginia	Local option	None	No	None	None
Washington	Yes	None	No	None	None
West Virginia	No	None	No	None	None
Wisconsin	No	None	No	Partial subsidy from state government	None
Wyoming	No	None	No	None	None

Note: An exemption indicates that your solar installation is not subject to being taxed (either as property or as merchandise). A credit is subtracted from taxes owed, while a deduction is subtracted from taxable income.

Maybe you thought catching smugglers, stopping poachers and saving lives only happens in the movies.

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vent pollution of our waterways and coasts. Maintaining the lights and markers that guide ships. Promoting safety in recreational boating.

Helping others is helping yourself.

It's not all hard work, though there's plenty of that.

In the Coast Guard, when your job is done and you're off duty, your time is your own. You can get out of your uniform and into your own thing.

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provide an allowance for housing and meals. So most of your pay is yours to keep—or save towards a new car, stereo equipment, even college.

And because we're smaller than the other military services, your chances of being recognized are greater. Good performance earns re-

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We protect our national resources, keeping our new 200-mile fishery conservation zone safe from "poachers" who illegally fish our waters.

These are big jobs, important jobs to our country and to the men and women who perform them. So are the other things we do. Working to pre-

SHORTWAVE LISTENING:

Trying to tune to one station among the crowded shortwave bands has always been frustrating—you never really knew your exact frequency. These new rigs tell you precisely where you are.

by Harry Helms Jr.



DX-300 from Radio Shack promises to be a popular receiver. The digital dial, coupled with high selectivity, lets you hear even weak stations.

Just how well does the new breed of shortwave radios perform? To find out, we tried two new entries: the Panasonic RF-4900 and Radio Shack's Realistic DX-300. Both feature the biggest innovation in shortwave radios—a *direct frequency readout dial* which makes finding desired stations a snap.

If you want to hear a station on 9650 kHz, using today's new gear, just set the LED dial to that frequency and, if conditions permit, you'll hear the station every time!

Today's equipment is lighter and smaller than ever. Receivers are also more sensitive—having the ability to pick up weak signals. Even the small, built-in telescoping "whip" antennas of today's shortwave sets can bring in signals from thousands of miles away.

Another important feature is a beat frequency oscillator (BFO) which allows single sideband (SSB) transmissions to be copied. SSB is a special form of voice transmission

QSL cards are sent as confirmations to shortwave listeners who report hearing the station's broadcasts. Some are very rare and highly prized by collectors. Most, however, are very colorful and eye-catching!



Digital dials make it easy!

used for virtually all ham, ship and airplane voice communication, as well as—to a growing extent—the citizen's band (CB) channels. When received on a radio without BFO, SSB sounds a bit like Donald Duck—completely unintelligible!

Both radios are impressive even before they are switched on due to their handsome styling.

For convenient operation, the RF-4900 features a two-speed tuning dial for precision tuning, while the DX-300 has a fine tuning control. The RF-4900 also boasts separate bass and treble controls, a RF gain control to prevent overloading from strong stations, and an antenna trimmer control to allow "peaking" your antenna for best performance on the various bands. The DX-300 counters with an audio filter to help eliminate interfering stations, an RF gain control with separate attenuator to reduce overloading and a preselector circuit to help match your antenna to the receiver. Both

sets have noise-limiter circuitry and BFOs for SSB reception.

Lab tests reveal that the DX-300 is a more sensitive receiver than the RF-4900 throughout the shortwave spectrum. The RF-4900 has the upper hand in selectivity, however. But these differences can't be detected in actual use; in a side-by-side comparison any station that could be heard on one radio could be heard equally well on the other!

An evening spent with the RF-4900 and DX-300 provided a fascinating window on the world. The LED dials made jumping from band to band a pleasure. Listening on 15170 kHz we heard Radio Tahiti filling the airwaves with beautiful South Seas guitar and flute music. Quickly tuning up to the 20-meter ham band, several American hams were heard calling fellow hams in the Soviet Union and Australia. Many foreign hams were louder than the Americans due to the vagaries of shortwave reception!

A spin through the utility bands revealed trans-Atlantic airplane flights in contact with airports in New York and Miami. Shipping traffic from vessels on the Ohio River and in the Gulf of Mexico was easily received in SSB, with the BFO circuitry in both sets easily changing the garble into perfectly readable speech. Dropping down to the 60-meter tropical broadcasting band, we found it filled with loud stations featuring bouncy Latin rhythms and rapid-fire Spanish speech.

Which radio is best? Both are so close in terms of shortwave performance that the question is meaning-

(Please turn to page 198)



Panasonic RF-4900 features a digital readout and other conveniences. Since it receives FM broadcasts as well as shortwave, the bass and treble controls come in handy. If a signal's there—you'll hear it!

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SHORTWAVE LISTENING

(Continued from page 197)

less. But there are features which may make one better suited for your particular needs. The RF-4900 covers the FM broadcasting band with a full digital readout, and has such niceties as an FM antenna terminal and AFC (automatic frequency control) to insure best FM reception. The DX-300 doesn't cover FM, but does cover the "longwave" portion of the radio spectrum from 10 to 500 kHz. Reception on longwave is best at night, with range up to a few thousand miles. This band is mainly used by utilities such as ships and aircraft beacons.

Tuning the world

Both the Panasonic RF-4900 and Realistic DX-300 are known as "general coverage" receivers, meaning that they cover the radio spectrum from the lower end of the standard AM broadcast band at 540 kHz all the way up to 30 MHz. The radio spectrum is divided for use by broadcasters, hams, ships, aircraft, the military and others by international agreement. In the early days of radio, it was common to measure frequencies by wavelength, and this practice is continued for convenience; for example, the 9500-9725 kHz broadcasting band is referred to as 31 meters.

Reception on various frequencies changes during the day. In general, you'll find 12000-130000 kHz best during the daytime and 3000-12000 kHz best during the late afternoon and at night. Reception conditions vary from day to day, however, with

most SWLs (shortwave listeners) agreeing that DX (long distance reception) is best in spring and fall.

Many world governments beam programs in English to North America during our evening hours. Most of these programs can be found in the 49-, 41-, 31- and 25-meter bands. These programs include newscasts, commentaries and features on life and culture in their nations. These are hardly objective, yet they offer fascinating insights into how foreign nations view world events.

But not all shortwave broadcasting is government controlled. In many foreign nations, privately owned shortwave stations broadcast to isolated areas beyond the range of ordinary AM outlets. Most are located in the tropical regions, and found in the so-called tropical broadcasting bands of 120, 90 and 60 meters. Numerous stations from Latin America and Africa can be heard on these bands.

Several other frequency bands are allocated for ham radio operators. Hams mainly use Morse code and SSB transmission. The 20-meter ham band is the main one for the DX work, with 15 meters second.

Most other frequencies, outside those set aside for broadcasters and hams, are used by utility stations including ships, airplanes, overseas telephone circuits, the military and radio navigation beacons.

Many people enjoy the hobby aspects of shortwave listening. These "DXers" specialize in trying to hear low-powered, rarely heard stations from all over the globe.

Shortwave broadcasters, particularly those operated by foreign gov-

(Please turn to page 206)

WE TEST THE NEW RECEIVERS

Parameter	Realistic DX-300	Panasonic RF-4900
Sensitivity for 10 dB S+N/N		
2.5 MHz	0.3 uV	1.0 uV
5.5 MHz	0.3 uV	0.5 uV
11.5 MHz	0.3 uV	0.6 uV
15.5 MHz	0.4 uV	0.5 uV
28.5 MHz	0.3 uV	1.0 uV
FM sensitivity for full limiting.	Not available	6 uV for 72 ohms
FM selectivity to alternate channel interference.	Not available	Very good (70+ dB)
Shortwave selectivity at 10kHz to 100% modulated interfering signal.	45 dB	34 dB (wide) 71 dB (narrow)
Shortwave selectivity to 30% modulated interfering signal (standard test).	50 dB	43 dB (wide) 73 dB (narrow)
AGC (automatic gain control) factor for input signal range of 1-10k uV (80 dB). The lower the number the better.	6 dB	11 dB
Digital frequency readout accuracy referred to laboratory frequency meter.	Fixed calibration all bands. Worse-case accuracy 500 Hz.	User adjustment of nominally ± 10 kHz referenced by user to frequency of known station. Insignificant variation from band to band.
Digital readout resolution.	1 kHz	BCB and SW, 1 kHz; FM, 10 kHz
FM automatic frequency control (AFC) lock-in range.	Not available	± 100 kHz of station frequency (excellent).

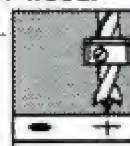
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PROFESSIONAL WOODBITS are **NOT** available in hardware stores. Stores only carry spade bits which tear grain, clog and bind; or metal-cutting twist bits that also bind and — what's worse — "skate" off the mark.

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A PROFESSIONAL WOODBIT has four features designed specifically for wood:

- A CENTER SPUR that locks your bit on course and so prevents "skating".
- TWO CUTTING SPURS that start and dimension a perfectly round hole.
- EXTREMELY SHARP FLUTES extend from the two cutting spurs and continue the cutting action all the way through the wood . . . shaving the sides smooth. Most important, the two spurs will not splinter the wood as the bit cuts through . . . as spade or metal cutting bits do.
- THE CUTTING FLUTES ARE ENGINEERED for maximum chip ejection so that your drilling machine won't bind and burn out.



LEICHTUNG'S PROFESSIONAL WOODBITS can be used in portable drills or drill presses with chucks of $\frac{3}{8}$ " or more. 7 piece chrome-vanadium steel set includes $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ " and $\frac{1}{2}$ " sizes. Lengths from $2\frac{3}{4}$ " - $5\frac{3}{4}$ ". Made by German professionals for pros or "wood-be" pros.

7 PIECE WOODBIT SET ONLY \$15.95



Depth Adjusting Collars For The 7 Piece Set

Get the precision of a costly drill press for under \$10.00! Here's how they work: Figure the desired depth of the hole; slip the collar over the bit to that depth; fix the collar position with the set screw — and drill. 7 collar sizes, $\frac{1}{8}$ " - $\frac{1}{2}$ ", fit each bit in the 7 piece woodbit set. Tool steel.

7 Piece Depth Adjusting Collars ... ONLY \$9.95

Buy Both Bits and Collars (SAVE \$2) ... ONLY \$23.90

Complete Your Bit Set With These 4 BIG WOODBITS

Primarily for use in a drill press, these larger diameter bits can be used in any powerful portable drill with a $\frac{3}{8}$ " or larger chuck. These are really top quality professional cutting tools. The $\frac{5}{8}$ " bit is $7\frac{1}{2}$ " long, the $\frac{3}{4}$ ", $\frac{1}{2}$ " and 1" are $8\frac{1}{2}$ " long. No collars available.

$\frac{3}{8}$ " BIT \$10.95 $\frac{7}{8}$ " BIT \$13.95

$\frac{3}{4}$ " BIT \$12.50 1" BIT \$15.50

BUY ALL 4 BIG BITS (SAVE \$12.95) ONLY \$39.95

COMPLETE 18 PIECE DRILL SET (SAVE \$16.80) ... \$62.00

18 PC. SET INCLUDES: 7 Bits: $\frac{1}{8}$ "- $\frac{1}{2}$ "; 7 collars to match plus 4 BIG WOODBITS: $\frac{5}{8}$ "-1".

Yes Ric Leichtung, please send me:

- ___ 7 pc. Woodbit Set(s) @ \$15.95
- ___ 7 pc. Depth Collars To Match Above Set @ \$9.95
- ___ 14 pc. Bit and Collar Set(s) @ \$23.90 (SAVE \$2.00)
- ___ $\frac{5}{8}$ " BIG Woodbit(s) @ \$10.95
- ___ $\frac{3}{4}$ " BIG Woodbit(s) @ \$12.50
- ___ $\frac{7}{8}$ " BIG Woodbit(s) @ \$13.95
- ___ 1" BIG Woodbit(s) @ \$15.50
- ___ All 4 BIG Woodbits @ \$39.95 (SAVE \$12.95)
- ___ Complete 18 pc. Drill Set(s) @ \$62.00 (SAVE \$16.80)

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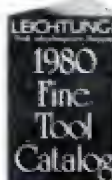
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**THE WEATHERTRON® HEAT PUMP
SAVES 30-60% ON HEATING COM-
PARED TO DUCTED ELECTRIC HEAT,
DEPENDING ON WHERE YOU LIVE.**

Even if your electric rates have in-
creased as much as 40% in the
last few years, you can still save
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pump from General Electric.

How does it work? By actually
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the outdoors and transfers it to
the indoors.

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energy-efficient way.

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Usage

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190	10
1	10
80	18
1	30

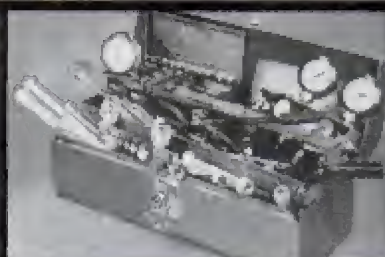
It's really no wonder that the General Electric Climatuff™ compressor, the device that helps extract heat from the air, has been operating in over two million cool- as well as heating installations.

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That's why the Weathertron heat pump from General Electric could be one of the most important things you put in your home.

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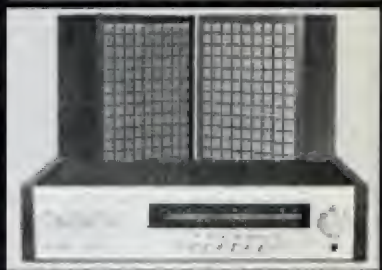


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Turns any room into a guest room. The ideal portable bed for holiday and vacation visitors...and it stores easily. Take The Air Bed camping, in your van, on your boat, in your summer home; sunbathe and float on it!

Available in twin, double, queen and king sizes. Inflates in minutes with most air pumps or canister vacuum. (High power air pump available—optional.) Made of sturdy 20 gauge poly vinyl, cleans with soap and water. Repair kit and pump adapter included.

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Contemporary Marketing, Inc.

790 Maple Lane, Bensenville, IL 60106

PMMC-305

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SHORTWAVE LISTENING

(Continued from page 198)

ernments, often welcome letters from listeners. They are especially interested in comments and reception reports. Shortwave stations send out colorful cards, known as QSL cards, to listeners. These are considered proof that the station was indeed heard by a SWL, and are eagerly collected. **PM**

Shortwave listening sampler

Here's a typical roundup of what can be heard on shortwave in the United States and Canada during evening and late night hours. More precise schedules can be found in the bulletins of various SWL clubs.

Freq. (kHz)	Station
5985	Radio Mexico, Mexico City; Spanish music.
6090	Radio Kaduna, Nigeria; local languages and tribal flute and drum music.
6105	Radio New Zealand, Wellington; programs to islands of the South Pacific.
6165	Swiss Broadcasting Corp., Berne; programs in various languages, including English.
7270	Polish Radio, Warsaw; English and Polish programs beamed to North America.
9410	BBC, London; English programs in their world service.
9475	Radio Cairo, Egypt; English service, much Arabic music.
9530	Radio Moscow, U.S.S.R.; English-language programs beamed to North America.
9575	Italian Radio and Television Service, Rome; English programs to North America.
9670	Radio Australia, Melbourne; English news and features (best late nights and early mornings).
10040	Voice of Vietnam, Hanoi; English and Vietnamese programs, Vietnamese music.
11705	Radio Sweden, Stockholm; English and other languages.
11815	Radio Japan, Tokyo; alternating each half hour with English and Japanese.
11680	Spanish National Radio, Madrid; news in English, much Spanish music.
11915	HCJB, Quito, Ecuador; missionary station with many English religious programs.
15045	Radio Peking, China; English language broadcasts to North America.
15170	Radio Tahiti, Papeete; French and Tahitian programs, music of the South Seas.

Clubs and publications

American Shortwave Listeners Club, 16182 Balled Lane, Huntington Beach, Calif. 92649.

North American Shortwave Assn., Box 13, Liberty, Ind. 47353.

SPEEDX, Box E, Elsinore, Calif. 92530.

Review of International Broadcasting, c/o Glenn Hauser, University Radio WUOT, Knoxville, Tenn. 37916.

Newark News Radio Club, Box 539, Newark, N.J. 07101.

SHORTWAVE FREQUENCIES

International broadcasting bands

120 meters	2300-2500 kHz
90 meters	3200-3400 kHz
60 meters	4750-5060 kHz
49 meters	5950-6200 kHz
41 meters	7100-7300 kHz
31 meters	9500-9725 kHz
25 meters	11700-11975 kHz
19 meters	15100-15450 kHz
16 meters	17700-17900 kHz
13 meters	21450-21750 kHz
11 meters	25600-26100 kHz

Amateur radio (ham) bands

160 meters	1800-2000 kHz
80 meters	3500-4000 kHz
40 meters	7000-7300 kHz
20 meters	14000-14350 kHz
15 meters	21000-21450 kHz
10 meters	28000-29700 kHz

U. S. citizen's band

Channels 1-40	26965-27405 kHz
---------------	-----------------

DO IT WITH

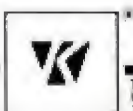
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Even receives CB!

- Watch TV — VHF and UHF
- Enjoy AM and FM radio
- Play tape cassettes or record them via the built-in mike or right off the air (radio or TV)
- Eavesdrop on CB — all channels
- Get weather reports — instantly
- Listen in on public service bands — police, fire, marine, etc.
- Hear pilots talk to air controllers
- Even use it as a P.A. system
- Play tape cassettes or record them via the built-in mike or right off the air (radio or TV)

And note the tape cassette at the bottom of the photo. We put it there to help indicate how incredibly compact The Everything Set really is — only 15½" W x 10" D x 5½" H.

Never before has so much been offered in so compact a unit. A 100% transistorized/IC chassis — plus superb electronic design — makes it possible, without sacrificing features or performance.

IT'S SMALL, BUT BIG

The set is small enough to fit, without intruding, on a corner of your desk...on your kitchen table...or on your night stand. It weighs just 12½ lbs.

Yet the black-and-white TV picture is big enough to see without squinting, 3" when measured diagonally, big enough — and sharp enough — for you to read the line type on commercials and the credits on movies.

The sound is also big — thanks to a 5" heavy-duty speaker. And there are all the controls you need for perfect pictures — up-front knobs for channel selection (VHF 2-13 and UHF 14-83) and contrast...plus controls for brightness, vertical hold and horizontal hold.

The collapsible antenna extends to nearly 3 feet, and boasts a deluxe swivel/tilt mount to help you get the best reception. There's also provision for an external antenna.

AM...FM...PSB...CB

The Everything Set brings you four diverse bands for a smorgasbord of entertainment, information and eavesdropping.

There's the AM band (525-1605 KHz) and the FM band (88-108 MHz). They share a circular, easy-to-read tuning dial that lights up at the touch of a button, as does the separate dial for VHF (112-174 MHz) and CB (channels 1-40). A separate, built-in meter indicates maximum station reception.

On VHF, the aviation band extends from 118-136 MHz; you can hear pilots talking to airport controllers. Tune a bit higher, and listen in on the public service band: police, fire, marine, etc. Weather forecasts are broadcast continuously at the high end of the band.

Switch to CB, and eavesdrop on any of the 40 channels. (You can receive, but not

transmit.) A squelch control reduces or eliminates unwanted noise.

A TAPE RECORDER, TOO

Want to record right off the air — radio music, TV audio, sports broadcasts? Just tune in the program you want, then press the Play and Record buttons of the built-in tape recorder. Want to make a live recording? Use the built-in mike...or plug in an external mike (not included).

The Everything set accepts standard tape cassettes, and has just about every feature you'd want. There's a tape index counter (with reset button), so you can find any section of a tape quickly and easily. A variable sound monitor lets you control the speaker volume without affecting the recording level. (Useful when recording late at night.) And other features include fast forward, fast rewind, pause, cue, review, auto-stop, stop/eject, and automatic level control.

There's even a control to fade recordings in and out, to combine off-the-air recordings with input from an external mike, or to use The Everything Set as a portable public address system (indoors or outdoors).

FOR SLEEPYHEADS

A built-in timer works with the auto-stop to turn off the radio, TV or tape player after 15, 30 or 45 minutes, depending on whether you load the tape player with a C-30, C-60 or C-90 cassette. So you can doze off confident the unit will shut itself off.

PLUS, COMPLETE PORTABILITY

The Everything Set operates on any of four types of power, so you can use it anywhere — in your home or office...in your car, van, truck or boat...at a picnic...on a camping trip...wherever. Or send it off to college.

Most economical is AC (120V) power, using the 6-ft. cord provided. Also provided is an 8-ft. car cord that plugs into a cigarette lighter socket for 12V operation.

For complete portability, slip 6 alkaline D cells (not included) into the built-in battery compartment. Better yet, get 6 rechargeable D cells and a low-cost recharger. (G.E. makes one.) Or order the optional, rechargeable 6V Ni-Cad battery pack from us.



90-DAY LIMITED WARRANTY

The Everything Set is designed and manufactured by the Sampo Corporation of America, a pioneer in electronics since 1936. Their limited warranty covers the entire set for 90 days and the picture tube for 1 year. They have service centers throughout the U.S.

IT'S THE PERFECT GIFT

Just in time for the holiday season, we're making The Everything Set available by mail...for only **\$249.95**, plus \$6 for shipping/handling. This includes the AC cord, the 12V car cord, a collapsible sun shield for the TV screen, and a blank tape cassette.

If you order two sets at a time (keep one, give one) our price is even less — only **\$229.95** (plus \$6 shipping) for each.

The rechargeable 6V battery pack (for 6 hours of continuous TV operation) is yours for only **\$49.95** plus \$3 shipping/handling.

(New Jersey residents: add 5% sales tax.)

MONEY BACK GUARANTEE

Try The Everything Set for 15 days. If not delighted, return it (insured) for a prompt refund.

DON'T MISS OUT — ORDER NOW

Inventories may be tight for the holiday season, so order now. Send us your check or money order...or charge it to your VISA, Master Charge, American Express or Carte Blanche credit card. Please include your name, address, signature, type of credit card, account number and expiration date.

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Welding is easy and economical with a Lincoln AC-225 portable welder — even if you've never welded before.

Now you can do hundreds of building and repair projects using plate or sheet metal. Even hard surfacing and heating metal for bending.

Just follow the free *Welder's Guide* included. The AC-225 operates on 230 volt, single phase, 60 hertz input power; has only one dial for current selection, plus an electrode guide right on the machine.

Besides, the AC-225 is UL approved and built to last by Lincoln Electric — the world's largest producer of arc welding products. And the price is far less than you'd expect and includes accessories.

Find out more from your local Lincoln Electric Distributor. He's in the Yellow Pages under Welding Equipment and Supplies. Or send for a free Bulletin. The Lincoln Electric Co., Cleveland, Ohio 44117.



The Lincoln Electric Company
Dept. PM-1, Cleveland, Ohio 44117

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ELECTRIC

Enjoy a roaring fire . . .

the easy way, with PM's Log Splitter!

What could be more pleasant on a cold, cold day than the warmth of a roaring fire. And, you can have all the firewood you need and save time and money by splitting that firewood yourself. POPULAR MECHANICS LOG SPLITTER exerts some 10,000 lbs. of pressure and will easily split 2 ft. lengths of maple and ash logs 12 to 14 inches in diameter. With an I-beam backbone, double-acting hydraulic cylinder, control valve oil filter, 3-hp. gasoline engine and other features, you'll find this

log splitter easy to build and a fun thing to use. And, you'll save your back from aching as you split logs the easy way. Have more time to enjoy the crackling fire in your fireplace. Use it through this year, or start getting ready for next winter. Either way, it's a very sound investment. Send for complete plans and step by step instructions for just \$8.95. Send a check or money order to PM Plans Library-Log Splitter, Box 1014 Radio City Station, N.Y. N.Y. 10019

PM LOG SPLITTER

Popular Mechanics is a publication of Hearst Magazines a Division of THE HEARST CORPORATION.

CASSETTE RECORDER

(Continued from page 40)

called the take-up spindle or turntable. The spindle to the left is known as the supply spindle. You'll find that the take-up spindle pulls the tape in both play and fast forward modes. The pinch roller and capstan pull the tape across the tape head, feeding it into the cassette hub with the take-up spindle. When in fast forward mode, the pinch roller and capstan are disengaged, letting the take-up spindle operate at a faster speed. The supply spindle is driven in reverse direction for fast rewind.

If the motor is rotating with no tape action, check the drive belt and capstan flywheel. Now, leave the cassette out of the player. Notice if the capstan drive and pinch roller are moving in play position. If not, check the motor and drive belt. When the capstan is moving and the pinch roller is not, then the pinch roller assembly is not engaging the capstan drive area. Check for a frozen pinch roller assembly.

A dry drive pulley or oil on the spindle drive area may produce no, or erratic, fast forward. Check the take-up spindle or turntable for dry bearings. Remove the top "C" washer or cap and pull the spindle off. Clean off the old grease on the bearing area and put on a drop of light machine oil for lubrication. Clean off the spindle drive area and drive pulley with alcohol and a cleaning stick. Excessively worn spindles may make a chattering noise and should be replaced. Don't be misled; sometimes the cassette plastic hub area will become dry and produce chattering noise, especially at the end of the tape.

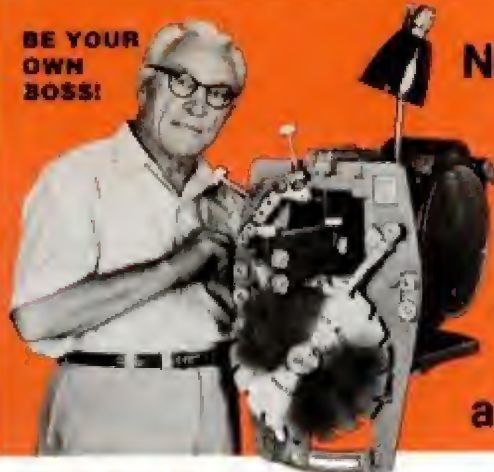
Torn and unraveled tape

Tape being torn out of cartridges or cassettes may be caused by a sticky capstan drive or pressure roller. The pinch roller may be out of round or excessively worn, causing the tape to pull up and out. But, in most cassette players, pulling or bunching of tape is caused by an erratic or inoperative rotation of the take-up turntable.

Check the take-up spindle with the cassette out of the holder. If the take-up reel seems to be running slow or stops entirely, you have located the tearing problem. Notice if any oil or grease is on the bottom drive pulley of the take-up spindle. The drive pulley is rotated from the capstan flywheel assembly. Maybe the drive pulley is not engaging the flywheel. Generally, a good cleanup

(Please turn to page 210)

**BE YOUR
OWN
BOSS!**



Now you can cash in on the huge demand
for **SHARPENING SAWS and TOOLS.**

Make \$8⁰⁰ an hour...

**or more. Work part time, full time, right at
home. No layoffs. No strikes. Provides
a steady source of year round income.**

**Read What These Foley
Shop Owners Say:**

**Shop will gross \$40,000...
... likes being independent**

"I worked in various industrial jobs for years, and always wondered if I could make money for someone else, why I couldn't do it for myself. So after losing my regular job, I opened my Foley sharpening shop in the basement of my home. I only had a minimum of cash to start with, but Foley financed the balance. My shop will gross over \$40,000 this year, and I like the feeling of running my own shop without answering to someone else."

**William Wescott
Willoughby, Ohio 44094**



**Husband and
wife have a
going spare
time shop**

"I'm a construction foreman, and my wife is a nurse's aide. Our Foley shop fits in nicely with our regular jobs, and we earn extra money. Our sons help out too, so ours is a real family business."

"I'm still too young to retire, but when I do I'll have a very good business built up. Foley equipment helps us to do good work and brings customers back with more jobs on a regular basis... we have a lot of repeat business the year around."

**Victor Kosloski
Sturgis, Michigan 49091**



**Glad he
chose Foley
for his saw
shop**

"I worked as a carpenter all my life, but when a back injury forced me to quit I decided to go into sharpening full time. I'm very proud of my shop and glad my choice was Foley equipment... it is superb. I made over \$48,000 last year, and this year it will go more than \$50,000."

**Victor Johnson
Lincoln, Nebraska 68507**

**This can be one of the most
important decisions you ever make**

Going into business for yourself can be the most exciting and rewarding decision you're likely to make in your lifetime.

Owning your own business brings you a sense of independence. You're the boss, setting your own work hours. Your own effort builds the business for yourself and your family. You can achieve great satisfaction and profits, if you choose and manage your business wisely. That's why so many men, just like you, are cashing in on the big profits to be made in this fast-growing service field.

The sharpening business allows you to get started with only a minimum investment, requiring little space and effort for a successful operation. It lets you build and expand as fast, or as slowly as you like. You pocket most of the money you take in, because there are exceptionally high profits with no investment in merchandise.

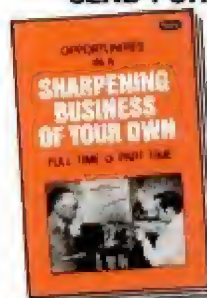
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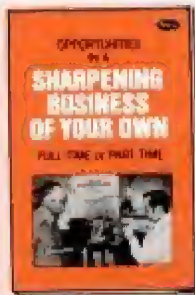
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CASSETTE RECORDER

(Continued from page 208)

of the capstan flywheel and spindle drive surfaces solves the unraveling of cassette tapes.

Constant change of direction

Many auto players have cassettes that will reverse and play in the opposite direction when they reach the end of playing time. It will do so continually until it's turned off or another cassette is installed. But when the player continuously shifts directions rapidly, suspect a dirty commutator switch at the other end of the take-up reel.

Remove the bottom cover and locate three tongs of leaflike springs rotating over a commutator hub. Clean off all grease and dirt with alcohol. Clean up the tong areas. If the leaf springs aren't engaging the commutator surface, loosen the small mounting screw, apply pressure toward the hub and retighten the spring holder. Also check for the possibility of a broken wire or leaf holder.

Demagnetizing after repairs

After working around the tape head with metallic tools, or measuring the continuity of the head with an ohmmeter, the tape head should be demagnetized. Head magnetization is evident when a high hissing or low popping sound is heard. When the unusual noise appears in your cassette player, determine if the cassette is noisy or the head needs to be demagnetized.

Simply insert a new cassette, or one which is completely erased. Turn the volume on full and listen for a noisy sound. If noisy, demagnetize the tape head. To check for a noisy amplifier section, turn the volume wide open, leave the cassette out and place in play position.

Choose a slender tool

Tape demagnetizing tools come in various sizes and shapes, but you should choose one that is slender and will get down inside to the small tape head. Some demagnetizing tools have an exposed metal or plastic end.

If it is metal, place a layer of cellophane tape around it to prevent metal contact from tool to tape head. Go slowly back and forth over the front area of the tape head four or five times. Slowly draw the tool away from the cassette player. Shut the demagnetizing tool off after removing from the tape head. The tape player should not be functioning when you are demagnetizing the tape head.

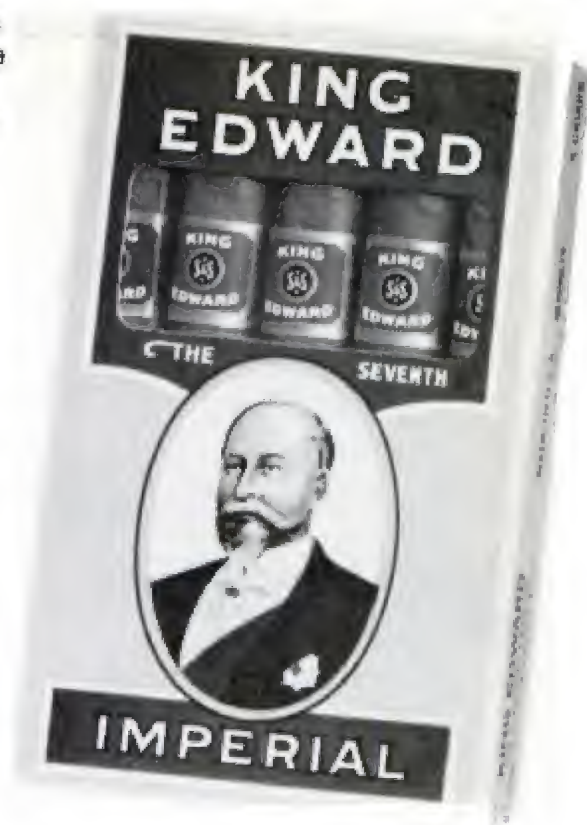
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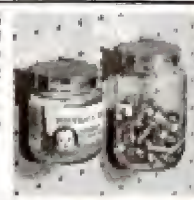
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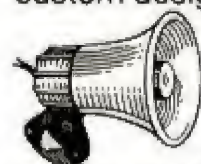
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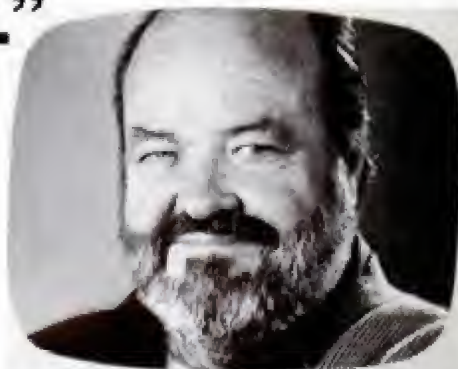


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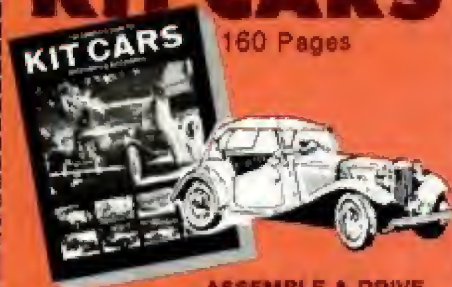
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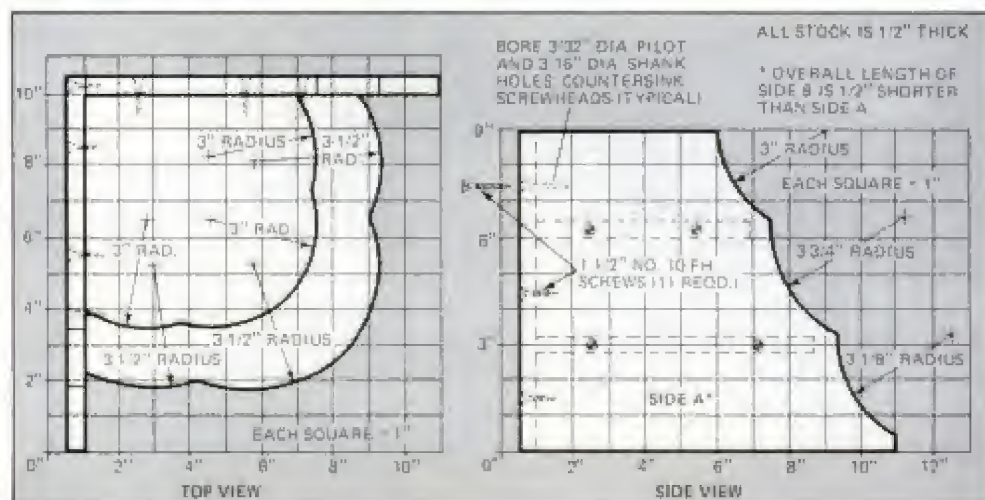
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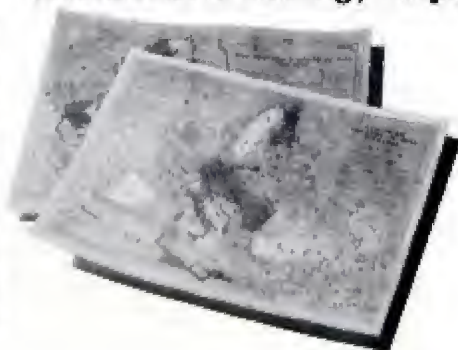
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Use-test consisted of gouging soft pine—circled area—then patching and staining to check finished appearance.

Fussy woodworkers will be happy to learn about a new latex wood filler that takes stain rather nicely. When the patch is to be stained, you immediately wipe the newly applied filler with a dampened cloth. An hour later it can be sanded and stained. It's well worth a try.—H.W.



Wood Patch can be applied with putty knife; excess is immediately wiped off.



An hour later, material can be sanded.



Small repaired area (circle) is practically invisible after staining. Product works well on such small patches.

SPECIFICATIONS—ZAR WOOD PATCH

Latex base wood filler, water washable. Available in 1/4-, 1/2- and 1-pt. cans for \$1.15, \$2.15 and \$2.95, respectively, at hardware and paint stores. Manufacturer: United Gilsonite Laboratories, Scranton, Pa. 18501

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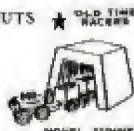


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- 100% solar-powered, you never replace batteries
- No resetting of calendar, not even in leap years

Space age accuracy

Now you'll never worry about accuracy again. Because the Sunwatch will keep you on time for the rest of your life. (Accurate to within 1 sec. per month.)

Solar age efficiency

Miniature solar cells automatically convert sunlight, daylight or ordinary bulb light into usable energy for storage. The solar cells last virtually forever. So you'll never replace a watch battery again.

Programmed for over a century

The built-in computer on a chip will always display the correct time date and month. Also, it automatically adjusts the watch calendar for long and short months, leap years and it's programmed until the year 2100!

Easy to read

The natural side-view display lets you tell the time, day and date without twisting your arm into an uncomfortable position.

Numbers always visible

Four varying light intensities are built into the viewing display, allowing the Sunwatch to adjust automatically to any light. This means you can always read it, even in the brightest sunlight.

10 Display functions

The Sunwatch is capable of displaying the following information: hours • minutes • seconds • months • date • day • leap year • speed calibration • AM/PM indicator • seconds count-off.

Extreme accuracy

Unlike other electronic watches using tuned crystals to control timing accuracy, the Sunwatch incorporates a unique, programmable, microcircuit synthesizer to make it the first watch in history that is accurate to less than 1 second per month. That's 5 times more accurate than the latest quartz Accutron.

The Power Source

Tiny silicon power cells, which are constantly being energized by natural sunlight, daylight or an ordinary light bulb keep the Sunwatch energy storage system charged. Should the watch not be exposed to light, it will continue to operate for months on stored power.

The most indestructible watch in the world
The workings of the watch: solar panels, energy cells, quartz crystal, computer on a chip, etc., are all permanently sealed in a Lexan module. This module is so unique it's protected by U.S. and foreign patents.

Completely waterproof

Leave the Sunwatch in salt water for months. Dive with it in depths up to 750 feet. There are no openings — magnetic slide bars activate all functions. With Sunwatch's exclusive, permanently sealed Lexan module, there are no "O" rings or seals to leak.



Shock resistant to 25,000 G's

You can crash it into a rug-surfaced brick wall at 90 mph with no noticeable effect. Wear it while doing heavy work, exercise or any strenuous activity.

Temperature resistant

Put the Sunwatch in boiling water for 30 minutes, freeze it in a block of ice for a year. Extreme temperatures will not damage your Sunwatch.

Pressure resistant

There are no air spaces inside the Sunwatch. Therefore, it is not susceptible to high pressures such as might be encountered diving to great depths.

The perfect watch for a lifetime

Imagine split-second accuracy for the rest of your life. Sunwatch is a virtually indestructible, beautifully styled, space-age timepiece, and it's available in three exciting finishes: Brushed stainless steel, Gold plated stainless steel, or a Durable black finish on stainless steel. All Sunwatches come with a matching stainless steel band with removable links and adjustable clasp.

Made in the United States

The Sunwatch, designed by Roger Riehl, was being worn by its inventor nearly a year before the first electronic digital watch was even available to the general public. Since that time constant engineering evaluations and design improvements have been made on the Sunwatch to incorporate the latest in digital micro-circuit and solar power technology. Thus the Sunwatch today represents state-of-the-art electronics technology. It is built to the same rigid standards practiced by the manufacturer in creating sophisticated computer micro-circuits for the U.S. Government and other major users of these components.

* A word about other "Solar Watches"

Roger Riehl, designer of the Sunwatch, states that there is no other completely solar powered watch on the market today. Claims of solar power by other watch manufacturers are based on the use of a small solar cell. Due to their limited size, these cells can be proven, in technical terms, to be of virtually no significant value in extending the life of a watch battery. For this reason, all other so-called "solar watches" must have replaceable batteries. The Sunwatch's power storage system, however, need never be changed and is, in fact, permanently sealed to withstand abuse and the elements.

Unique and memorable gift

Available in a special gift box (see order form) the Sunwatch makes an ideal gift for special holidays, birthdays, graduation, Father's Day, etc. Perfect for business people, commuters, teachers, athletes and sportsmen, who require split second accuracy.

Free custom engraving

At your request, each Sunwatch will be hand-engraved with the name you specify.

Limited Warranty is your protection

The Sunwatch is covered by a 2 year limited warranty issued by Riehl Time Corporation (manufacturers of the prestigious Synchronar 2100) and included with your watch. A copy of the warranty may also be obtained free of charge by writing to Future Concepts, 41 Holiday Park Dr., Hauppauge, NY 11787. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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Excuse Me!

The watch shown here is the newest concept in today's electronic marvels. Can you figure out why?

We salute Natron. Their innovative technology has brought us a breakthrough in digital watches.

Natron, one of the world's most admired watchmakers, has developed the most advanced timepiece of its kind in the world. By combining every known computer function that you could possibly desire in this spaceage era. Their quality features and advanced electronic knowledge is truly outstanding.

In the early 60's we began hearing about electronic wristwatches, whose basic beat came from a tiny tuning fork which provided accuracy guaranteed to within 2 seconds a day. Soon they became the best sellers in the country.

By the mid-70's an absolute explosion in digital watches was set off, with prices reaching as high as \$1,800. Manufacturers were working long hours day and night to keep up with the demand.

Now approaching the 80's we find that there are hundreds of manufacturers around the world making digital watches. There are models that tell you the time in two zones. Some offer a daily alarm, others a chronograph feature, ranging in price from \$125 to \$2,500.

Our company was faced with a dilemma. Which digital do we offer our valued customers in our national advertising campaign?

The president of our company was intent on finding a watch that had more microelectronic features at an affordable price than anything else on the market.

We made a study of all the watch manufacturing companies in the world, Omega's Marine Chronograph \$2,500, Seiko's New LC Alarm \$300 to Mercury's Global Executive at \$125. The results of our experiment were unanimously in favor of the Natron Alarm Chronograph, because this superior watch offers more features than the best-selling superwatches rolled into one, at a price the American public can live with.

The following are the reasons behind our decision: Natron's daily alarm sounds everyday at the hour and minute selected. Its computer

brain never forgets. The stopwatch feature with lap time operates independently at the flick of a button. Your choice of eight time zones in eight major cities, Los Angeles, Chicago, New York, Rio De Janiero, London, Paris, Cairo, Tokyo all programed by you in Natron's computer brain. You will have seconds, minutes, hours, day of the week, month and date. The Natron Chronograph also remembers the days in a month and instantly recycles to the correct first day of the month. Nine spaceage features in all, complete with a computer counter that will count your golf strokes (up to 1,300).

Service played a big part in our decision. The watch is guaranteed by a one-year parts and labor limited warranty — backed by two substantial companies. Since the Natron digital watch requires very little service other than a new battery every few years, which can be replaced by any jeweler, service has become less concerning. Should a malfunction ever occur there's a prompt Natron service-by-mail center as close as your postman — further reassurance that service was an important consideration in our experiment.

One of the major reasons for our decision was price. We went to the manufacturer and purchased thousands of watches directly from the factory without the normal mark-ups by importers, wholesalers and distributors.

We now can offer you the most advanced digital watch in the world for only \$69.95.

We would like you to be the judge. Order the Natron Digital Chronograph Alarm from Chandler's on a 30-day trial basis. Make your own comparison, compare Natron's quality features with the Omega, Seiko or any other brand. Examine and compare its accuracy, its alarm, and its nine chronograph computer functions.

If after a factual side-by-side trial, you aren't convinced that its quality, accuracy and features make it a truly remarkable watch, return it within 30 days for a full courteous and prompt refund. Chandler's promises to accept the return of your watch with positively no questions asked and even refund the \$3.50 postage and handling. There's no Risk.



National Electronics & Watch Co. Ltd. is a substantial public company with over forty years of manufacturing the most advanced watches known and Chandler's is one of America's innovative marketing companies specializing in unique products — additional assurance that your prudent investment is well secured.

To order your Natron Digital Chronograph Alarm, send your check for **\$69.95** for the silver-tone model or **\$79.95** for the gold-tone along with \$3.50 per order for postage and handling (Virginia residents, please add 4% sales tax) to our address shown below or credit card buyers may call our 24-hour Toll-free number below.

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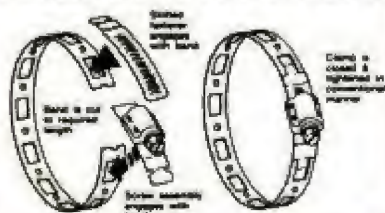
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ily decided to keep the timer and add an additional set of energy-saving controls.

Since the test, the family has saved 4079 kilowatts by turning off the water heater during the local utility company's peak power periods from noon to 7:00 p.m. Intermatic says the average annual saving of six homes tested with the timer was \$70.

Electric water heaters are the home's "biggest power-guzzling" appliance, according to Jim Miller, Intermatic's president. A large part of an electric bill is the cost of heating water.

In homes that are also heated electrically, about 17 percent of the electric bill goes to heat water. In homes heated with other fuels, the cost of heating water accounts for approximately 45 percent of the electric bill.

The automatic hot-water timer is priced at \$25; timer cost, plus installation by an electrical contractor, is about \$50.

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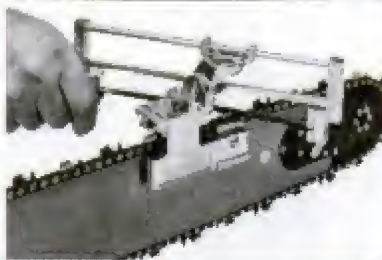
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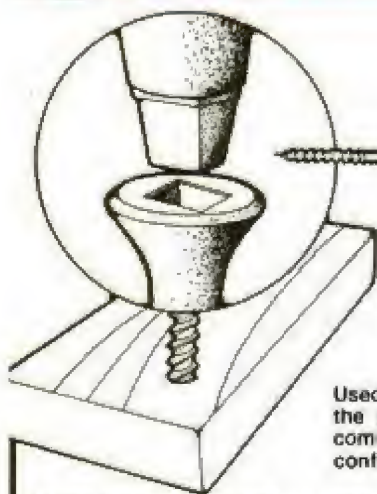


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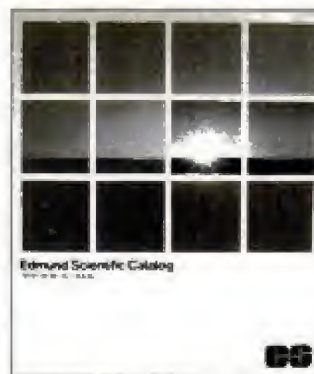
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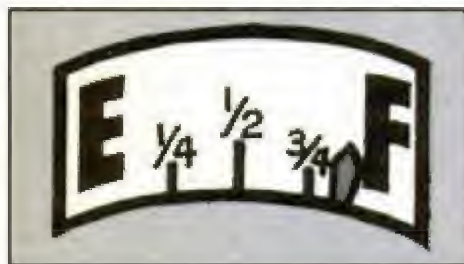
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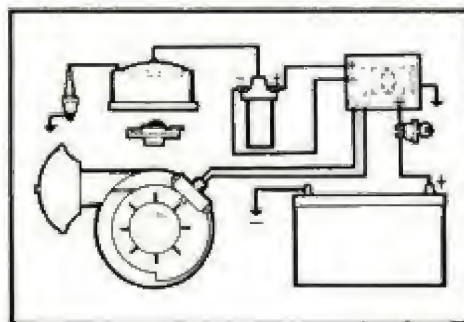


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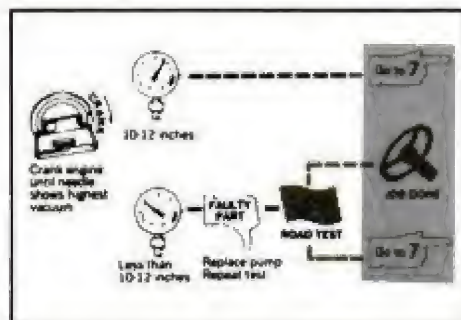
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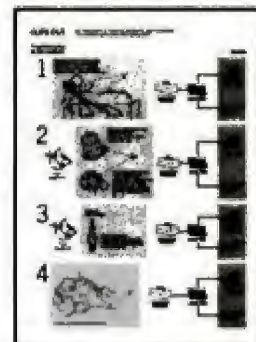
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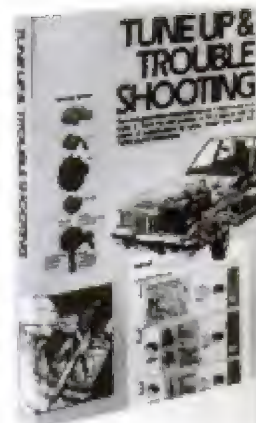
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- * Have you mailed that check to me yet?
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- * Have you told me everything I need to know?
- * Can I depend on you?
- * Are these figures correct?
- * Are you confident about this investment?
- * Will they settle out of court?

When you ask a direct question you deserve a straight answer. And that's the beauty of the Truth Machine; it will give you a straight answer. . . even if someone else doesn't. It's your best possible defense against doubt, risk, and deception.

YES, IT'S ETHICAL!

It's simply a fast, efficient way to verify the truth and protect yourself against dishonesty. And after all, which is immoral - for a person to be deceitful or to have their dishonesty uncovered? There is nothing unethical about uncovering deceit and deception. In fact, you can usually prevent dishonesty simply by letting everyone know that you own the Truth Machine. It's a powerful deterrent for anyone who is tempted to mislead you or tell you less than the truth!

IT'S AMAZINGLY SIMPLE!

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The principle is remarkably simple. Scientists already knew lying produced unconscious and uncontrollable stress that could be recorded by a polygraph. Researchers soon discovered that this stress also affected the muscles controlling the vocal cords, and caused an inaudible "microtremor" in the voice. All that was needed was a device sensitive enough to pick up and record these inaudible vibrations. And that was a relatively easy accomplishment considering the state of modern electronic technology.

BUSINESSMEN BECOME MIND READERS

In addition to police and intelligence agencies, many of the "Fortune 500" corporations have quietly been using voice stress analyzers for several years. Large industrial and retail companies use it to control employee theft and screen job applicants. And dozens of large insurance companies have been using voice stress analyzers to uncover false claims. They simply tape an interview with anyone filing a suspicious claim, then play back the recording and monitor it with a voice stress analyzer.

In the past only the largest, most profitable companies felt they could justify spending \$1500 to \$5000 to purchase a voice stress analyzer. However, like everything else in the electronics field, these high prices reflect the heritage of a prototype, and not the quality of a reliable voice stress analyzer.

The new cost-saving, solid state, micro-chip technology and mass production have made voice stress analyzers affordable. Today, for only \$149.00 you can have a compact unit that is far more sensitive than the top-secret units originally used by the military! There is no better way to get at the truth. . . and remove the risk and uncertainty from those important decisions that face you every day!

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EASY TO OPERATE!

Unlike the polygraph, there are no sophisticated operating techniques to learn. With our easy, step-by-step instruction manual you can easily master the Truth Machine with only a few hours of practice. You simply turn it on and adjust the sensitivity calibrator knob for average stress in the speaker's voice. Then sit back and watch the LED display. When the numbers on the digital read-out reach the stress area, you know you're hearing less than the truth. And it's versatile. You can pick up the speaker's voice with the Truth Machine's ultra-sensitive microphone. Or use the special sensor that connects it to your telephone.

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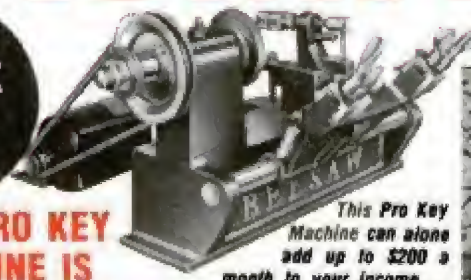
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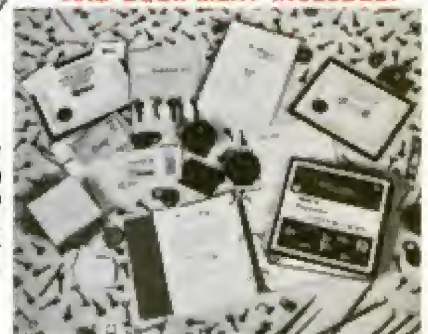
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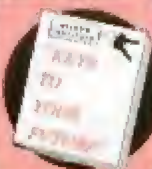


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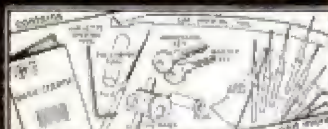
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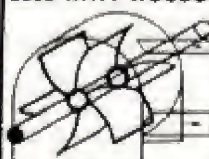


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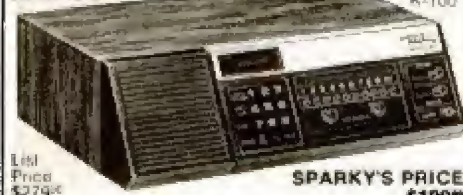


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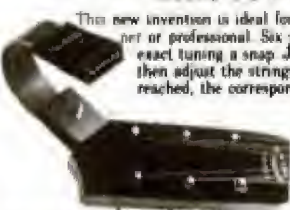


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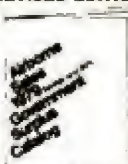


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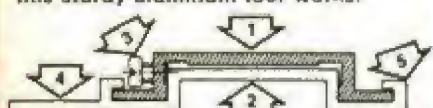
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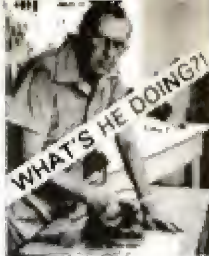
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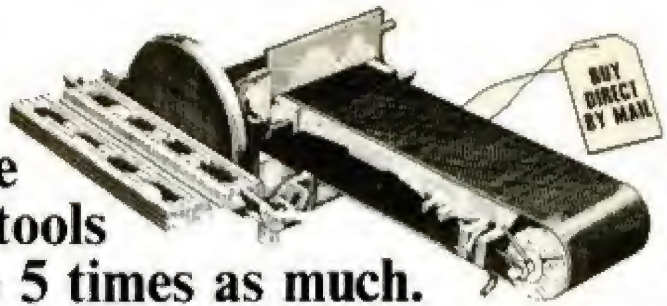
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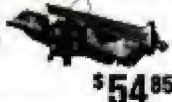
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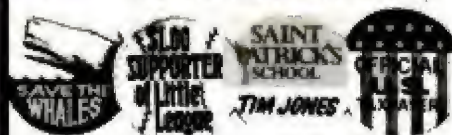
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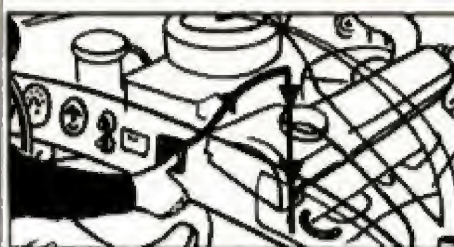
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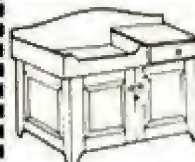
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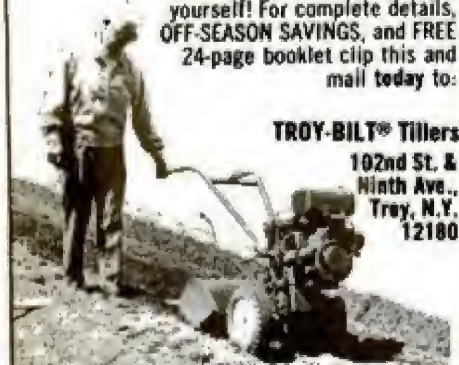
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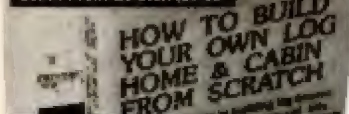
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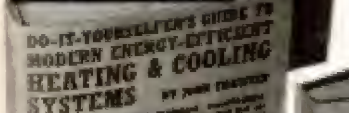
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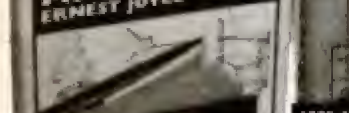
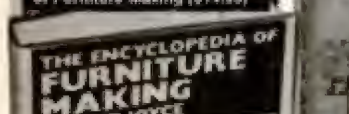
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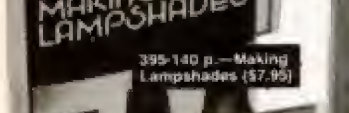
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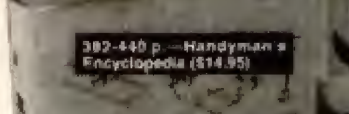
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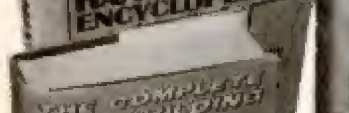
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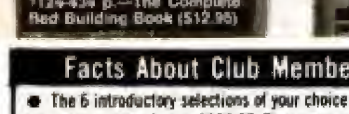
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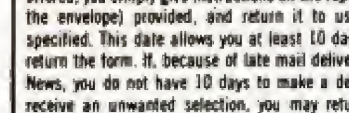
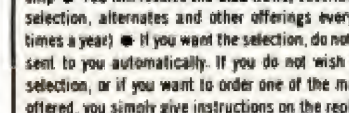
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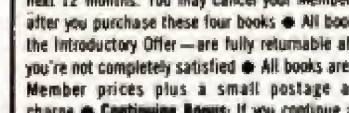
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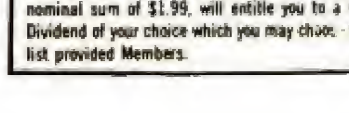
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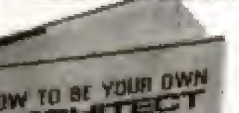
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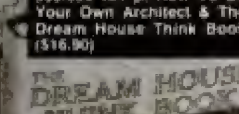
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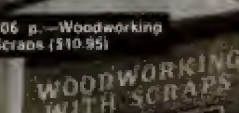
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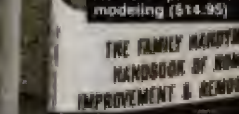
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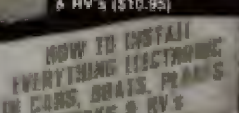
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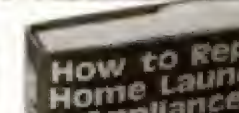
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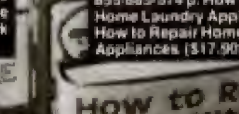
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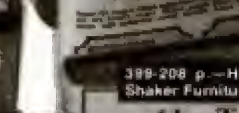
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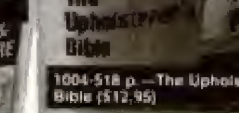
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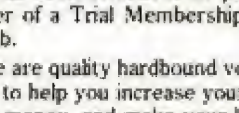
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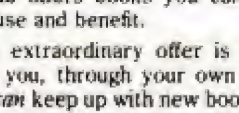
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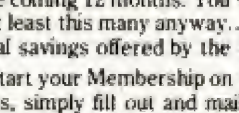
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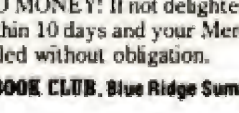
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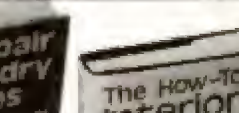
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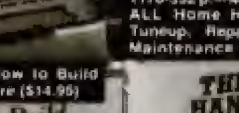
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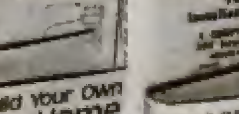
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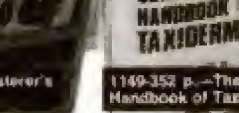
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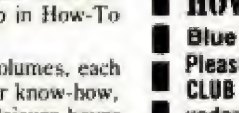
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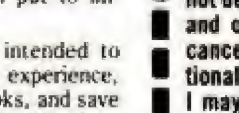
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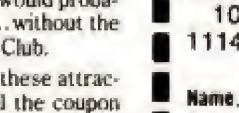
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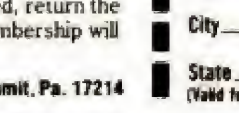
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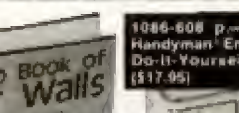
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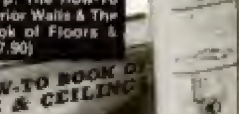
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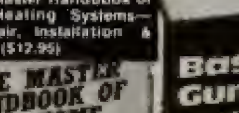
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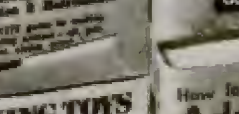
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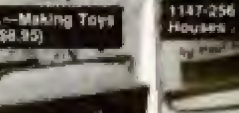
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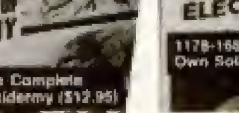
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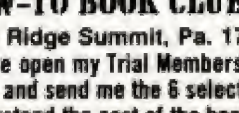
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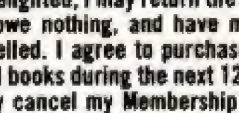
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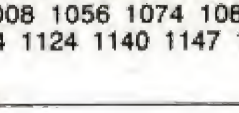
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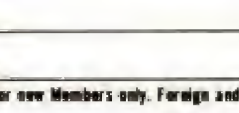
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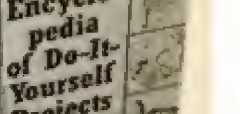
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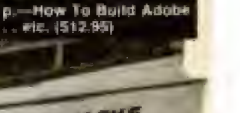
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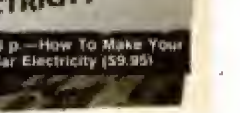
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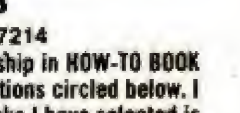
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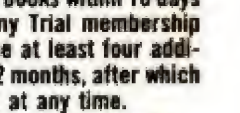
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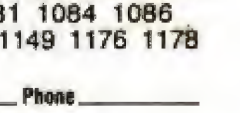
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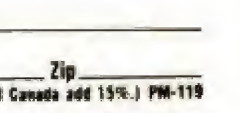
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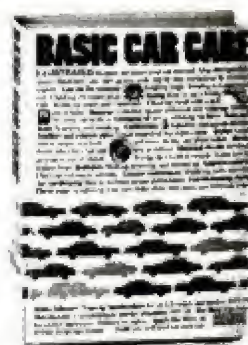
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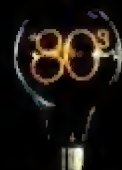
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